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Motorship

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Freight Motorship "WEST HONAKER"

Length overall 423 ft. 9 in. Tonnage: Gross 5424; Net 3372

THE "West Honaker" is the latest contribution of the McIntosh & Seymour Corporation to the Diesel Conversion Program. She is driven by McIntosh & Seymour Main Engine with independent compressor unit, and generators driven by McIntosh and Seymour Units furnish the auxiliary power.

On her trial trip the "West Honaker" developed a speed in excess of the specified requirements, and the trial was thoroughly satisfactory. The next day, she left Boston for Charleston, S. C., where she was loaded and sent to Europe in regular service.

McINTOSH & SEYMOUR DIESEL ENGINES

McINTOSH & SEYMOUR CORPORATION
AUBURN, N. Y.

JAN. 1927 PRICE 35c.

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Volume XII January 1927 *Number 1*

World's Biggest Shipping Magnate Sees Motorships Dominate Ocean

Lord Kylsant, Who Directs 3 Million Tons of Shipping, Predicts Leviathans of the Future Will Be Motorships and Cost Less Than Steamers

THAT for most trades and for almost every class of vessel including largest ocean-going passenger ships the Diesel engine is not only suitable already, but more economical to work than any sort of machinery, is a proved fact in the opinion of Lord Kylsant expressed in his Presidential Address to the Institute of Marine Engineers in London last month, according to *The New York Times*, which published on Dec. 15 a copyright account of the shipping magnate's speech received by its own special cable service.

That the Diesel engine will probably supersede steam even in the "hugest giants," is one of Lord Kylsant's predictions —a prediction that is tremendously significant when set side by side with the facts that the famous White Star Line with its MAJESTIC, OLYMPIC and HOMERIC has just been merged with his interests and that the three largest motorliners in the world, ALCANTARA, ASTURIAS and CARNARVON CASTLE are under his control. This is the first time that any pronouncement by a European shipowner has been reported in detail by cable, and *The New York Times* showed unique discernment in appreciating the importance of these statements, which are bound to rock American steamship owners from their complacent conservatism.

Lord Kylsant's companies control as much tonnage as the entire overseas foreign shipping of the United States, privately owned and Government owned. His ships aggregate very nearly as much in gross tonnage as the whole of the shipping in our coastwise trade. He directs 50 per cent more tonnage than the U. S. Shipping Board and all its operators have in service. His fleets are equal to one-quarter of all the tonnage of American sea-going motor and steam vessels of 1000 gross tons and over, in service and laid up, privately owned and Government owned.

Lord Kylsant is a creator. He did not fall heir to all this tonnage. He has built and purchased and merged and combined for years to attain his position as the world's biggest shipping magnate. He has always seen things in a big way and made them come true. To him, for instance, belongs the greatest share of the credit for having swung the huge transatlantic passenger travel from Liverpool to Southampton and made the latter one of the most important ports in the world.

That is the caliber of the man who predicts an ultimate future for steam about equal to that of the sailing vessel today. Further reports of his speech we are privileged to give below by the courtesy of *The New York Times*.

Lord Kylsant, World's Biggest Shipowner, Who Asserts—

Diesel engine is more economical to work than any sort of machinery.

Motorvessels can carry larger cargoes than steamers.

There can be a big saving in actual running costs.

Ratio of aggregate cost of higher speeds is less in motorships.

Additional capital outlay on motor vessels is more than offset by the result.

"Until comparatively recently doubts on the reliability of motorships existed," said Lord Kylsant. "These doubts were due partly to some minor failures arising from faults in design, which have been successively eliminated, and possibly to a larger extent to the difficulty in the earlier stages of always obtaining a staff of marine engineers familiar with Diesel engines.

"The experience of shipowners who have operated motorvessels is, however, that they are both reliable and dependable. Contrary to expectation, they compare favorably with steamships in the matter of vibration, and, since no smoke is given off, the motor enables the vessel to be maintained in a better state of cleanliness."

He declared, furthermore, that owing to the motor occupying less room than the steam engine, especially in the faster vessels, and to the enormous reduction in bunker capacity, motorvessels can carry larger cargoes than steamers of the same dimensions and speed, and that experience likewise shows that there can be a big saving in actual running costs.

"In ships of the same size and speed," he continued, "Diesel engines consume a ton of oil, as against four or five tons of coal required by reciprocating steam engines, and normally, in the case of passenger vessels, a ton of oil costs about two and one-half times as much as a ton of coal. In cases where speed is all important," he told his audience, "the ratio of aggregate cost of higher speeds is less in motorvessels than in steamers, and while, in a coal-burning ship, increased speed means a bigger stokehold force, there is no such increase in the oil driven vessel.

"There is still something to be said for steam," said Lord Kylsant. "For instance, the first cost of the motor at present is still somewhat higher than the steam engine, with the possible exception of the latest high-pressure turbine, but those who have tried both types are satisfied that the additional capital outlay is more than offset by the result."

The difference of cost is great in engines.

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of smaller power, he said, but the success of the double-acting Diesel engine is reducing the difference so greatly that in higher power engines it may disappear entirely. Moreover, the more extensive application of standardized methods to motorship construction may solve the problem of the present greater initial cost.

"As a result of my own 10 years' experience of motor vessels," he declared, "I am satisfied that the cost of upkeep and repair of Diesel engines is not too high compared with steam engines, and while no definite basis can yet be laid down regarding the rate of depreciation, I do not think anything exceptional need be anticipated."

Lord Kylsant said that the shipping companies of which he is Chairman, now have more than 50 motorvessels built or building, and that those already running had covered 7,500,000 miles.

Over 500 Ships and 3,000,000 Tons Under One Control

Lord Kylsant's Group of Companies Is the Biggest Shipping Combine the World Has Ever Known

WHEN on January 1 The Royal Mail Steam Packet Company took formal possession of the famous White Star Line fleet of transatlantic liners, recently acquired at a price reported to be approximately $35,000,000, there was brought together under the control of the Royal Mail and its associated interests the greatest fleet of merchant vessels ever assembled in the history of the world.

Nearly 3,000,000 tons of ocean shipping will carry the flags of the Royal Mail and its affiliated and subsidiary companies to every corner of the globe.

At the head of this gigantic shipping combination stands Lord Kylsant—"Lord of the Seven Seas," they are calling him in England now—a man who, starting his career in a subordinate position in a Glasgow shipping firm, now takes rank as the greatest shipping magnate England or any other seafaring nation has produced.

Since the days of the early Phoenician traders, men have dreamed of dominating the seas. Lord Kylsant, born in 1863 the third son of a minister, without the background of seafaring tradition, has come nearer to realizing that ambition than any other man. He acquired his first steamer in 1889; today he controls more than 500 ocean-going vessels.

Under the leadership of Lord Kylsant, the Royal Mail influence and field of operations have steadily expanded. Many of the oldest and best-known British shipping lines have been brought into the combination he has built up: Among the companies controlled by, or affiliated with, the Royal Mail, are The Pacific Steam Navigation Company, Lamport & Holt Line, Union-Castle Line, Nelson Lines, Elder Dempster & Co., and now the White Star Line.

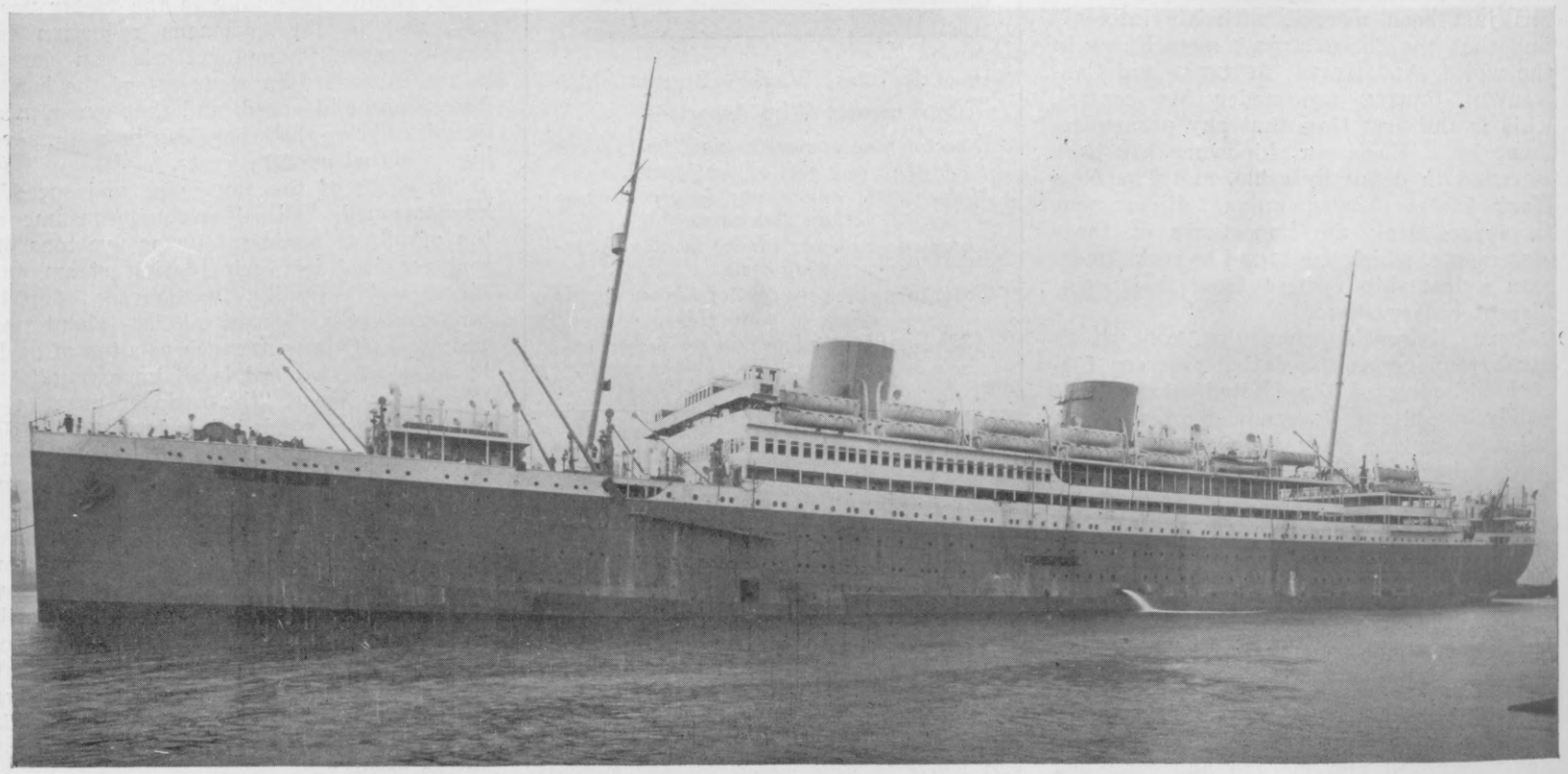
Founded in 1839 under a Royal charter granted by Queen Victoria, the Royal Mail has from the outset displayed a pioneering spirit. Its first fleet consisted of fourteen paddle-wheel steamers with sails, for use in the West Indies service. From that beginning, the company has constantly reached out into new fields and has sponsored or supported every important development in ocean transportation. Just as the company was the first to operate in transatlantic service a liner fitted with a screw propeller, so more recently it has recognized the possibilities of the motorvessel.

ASTURIAS, present queen of the Royal Mail fleet, is larger than any motor liner previously built. The company's pioneering spirit was further evidenced in 1925 by the arrangement of the first cruise from New York to South and East Africa, a venture which proved so successful that this season the ASTURIAS has been assigned to the second African cruise.

Through the purchase of the White Star fleet, the Royal Mail acquires such famous liners as the MAJESTIC—the world's largest ship—the OLYMPIC and the HOMERIC, as well as other large transatlantic liners. These celebrated ships will give further prestige to the shipping organization which was already the largest in the world and will enable it at once to rank second to none in the passenger service between New York and Europe.

In addition to the transatlantic service, the Royal Mail and its affiliated and controlled companies now operate lines from the United States to the East and West Coasts of South America, to West Africa, the West Indies and Bermuda. The Royal Mail is also a leader in ocean cruising, operating 25 de luxe cruises during the seasons of 1926-27. These include cruises from New York to the Mediterranean and the West Indies, in addition to the unique Great African Cruise which features the capital cities of South America as well as the countries of South and East Africa.

Ms. ACCRA, new passenger and mail motorliner of the Elder Dempster Line operating between Liperpool, England, and the West Coast of Africa, made record passages on two "legs" of her maiden voyage. She ran from Sierra Leone to Teneriffe in 3 days 23 hr. 14 min., and from Teneriffe to Plymouth in 4 days 4 hr. 12 min. ACCRA is powered with H. & W.-B. & W. Diesels.



Lord Kylsant's motorliner Asturias, which will leave New York this month for a cruise round Africa with a full American passenger list

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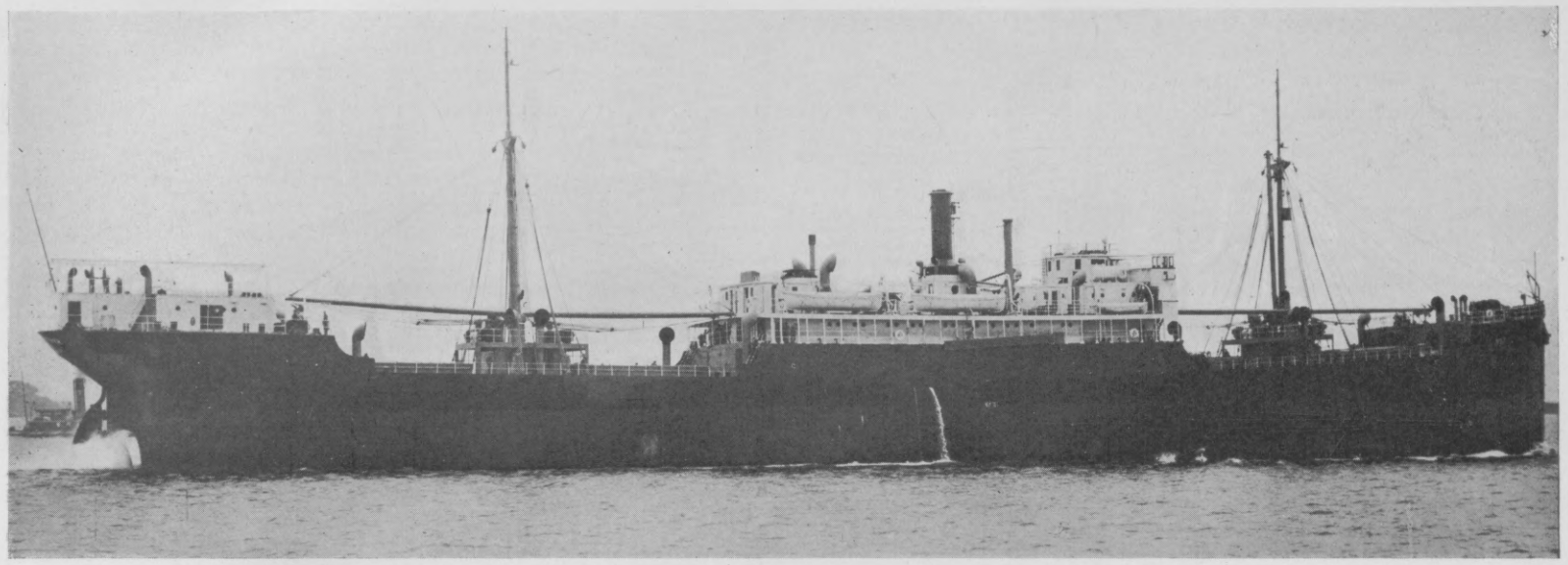

Conversion Work on Ms. West Honaker

Shows a Completeness and Such Thorough Realization of Present Day Requirements that Ship Is Equal of New Construction

IN considering the ex-steamship WEST HONAKER as a modern, up-to-the-minute motorship, it is necessary to remember that there is a distinction between the work which has been carried out on this ship and that which is ordinarily practically routine in conversions. A machinery conversion is concerned mainly with the removal of one type of machinery from the ship and the substitution of another, with, of course, the work of the necessary modifications to structural details which the new machinery demands. Work on the WEST HONAKER, and indeed upon the whole of the ships concerned in the Shipping Board Conversion Programme, involves more than the removal of steam driven prime movers with their boilers and accessories and the substitution for them of internal combustion engines with their accessories. This actually is the nucleus of the work around which has been arranged the complete modernization of the whole ship. A steamship with the steam engines removed and Diesels substituted is not a motorship. The Diesel *per se* being a more exacting type of prime mover than the steam engine demands a higher standard of equipment in every way, not only in the engine room but on deck also. The result is that WEST HONAKER and her sisters are something more than mere conversions. In actual fact they are, in everything but hull, new ships, so much so that we judged it necessary to treat ms. TAMPA, first ship completed in the Conversion Programme, as a new ship entirely. This article sets forth some of the principal work involved in the re-construction of the WEST HONAKER and shows how well the Shipping Board's technical staff has worked the details of the conversion.

Given, a three island cargo ship of more or less conventional type with steam reciprocating engines and water tube boilers, steam windlass, winches and steering gear; a hull arrangement with crew berthed in the poop, navigating and engineers' officers in a house on the bridge deck amidships; turn this ship into a modern, moderately fast motor freighter with all electric auxiliaries, the best of navigating appliances, and accommodations for a limited number of passengers. Such, in brief, was the problem confronting those concerned with the Shipping Board Conversion Program.

Work naturally falls under the head of deck alterations, navigational equipment alterations, accommodation alterations, and machinery space alterations. In some cases —notably in the case of the steering gear— existing equipment has been retained and modernized, but generally speaking, unless a unit of equipment or a portion of structure definitely lent itself to modernization or modification, new work has been substituted. The whole of the work concerned in the conversion of the WEST HONAKER has been carried out by the Bethlehem Sb. and D. D. Co. at their Fore River plant at Quincy, Mass., while McIntosh and Seymour of Auburn, N. Y., have supplied the main propelling machinery, which is of single-acting 4-cycle type. WEST HONAKER is first unit of a group of Shipping Board vessels upon which reconstruction work is being carried out by the Bethlehem Company at the Fore River plant, the engines of all of which are of McIntosh & Seymour type.

Characteristics of ms. West Honaker

Gross tonnage	5,428 tons
Net tonnage	3,374 tons
Length overall	423 ft. 9 in.
Length b. p	410 ft. 0 in.
Beam, molded	54 ft. 0 in.
Depth, molded to upper (main) dk.	29 ft. 9 in.
Displacement, load	12,086 tons
Draft at above	23 ft. 11¼ in.
Displacement, light	4,080 tons
Draft, light	8 ft. 10 in.
Power, main engine	2,700 b.hp.
Service speed, about	11 knots
Endurance	17,600 miles
Total deadweight capacity	8,006 tons
Fuel oil, double bottom	885.5 tons
Lubricating oil	3,970 gal.
Fresh water, total	214 tons
Cargo deadweight capacity (full endurance)	.....
Cargo deadweight capacity (half endurance)	.....
Cargo space capacity (bale)	393,000 cu.ft.
Cargo space capacity (grain)	386,449 cu. ft.
Deep tanks (liquid)	4,077 bbl.
Deep tanks (grain)	22,894 cu. ft.
Ballast water (peaks)	350.2 tons
Ballast water (deep tanks)	654 tons
Ballast water (double bottoms)	1,021 tons

Ms. WEST HONAKER was constructed as a steamer in 1920 at Los Angeles, Cal. She is a freighter of three island type with poop, bridge, and forecastle, with two large wells formed by the main deck between the erections. A total of seven watertight bulkheads divide the hull into eight watertight compartments which, respectively from forward, are the fore peak, No. 1 hold, No. 2 hold, No. 3 hold, which is a deep tank, the machinery space, No. 4 hold, No. 5 hold, and the aft peak. All these bulkheads are continuous to the main deck. The main deck is the topmost continuous deck and there is a continuous lower or second deck below this. The hull is constructed upon the ordinary transverse framing principle. This is in contrast with ms. TAMPA, which had longitudinal framing—rather an uncommon system of construction in freighters of this character. The holds are each served by one hatch 17 ft. 0 in. long, with a height of coaming on the main deck of 2 ft. 6 in. The holds are clear and well suited to the cotton trade, in which the vessel is now operating. The 'tween decks space makes her useful for general package cargo carrying, and in addition there is space for cargo of this nature in the bridge 'tween decks and in the poop. There are no grain center divisions, but this fact—in spite also of the second deck—should not debar the ship from some of the other lucrative bulk trades, such as coal and ore carrying.

The forecastle is occupied on the port side by cargo space and on the starboard side by bos'un's stores, paint room, lamp room and carpenter's shop. Watertight doors are fitted, making the structure easy

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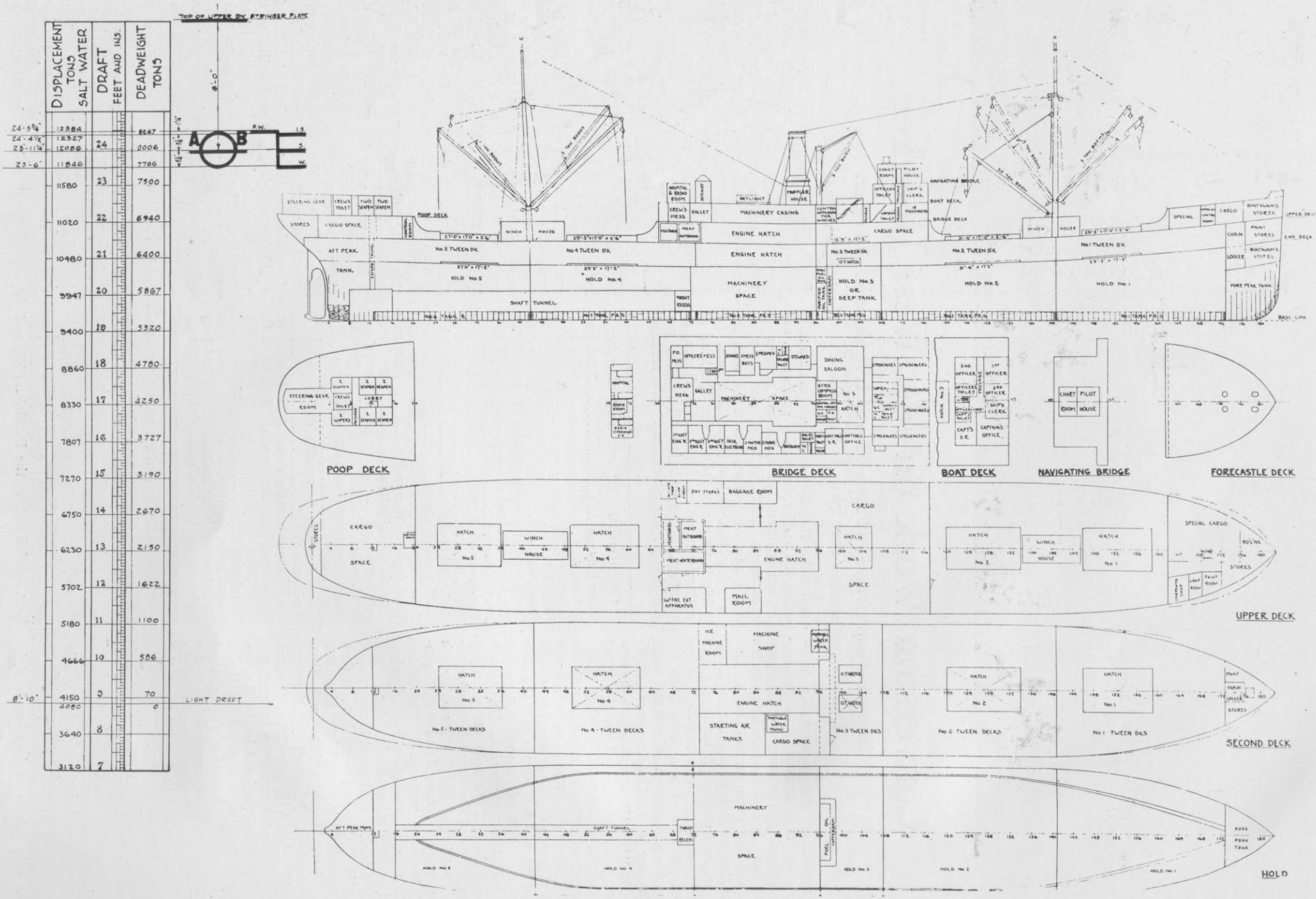

General arrangement plan and deadweight scale of converted single-screw freighter West Honaker, owned by the Shipping Board and now equipped with a 2700 s.hp. Diesel

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to isolate. This, provided there are no means of access for water from the deck overhead, is a useful asset when a ship is plunging into a head sea and shipping quantities of water over the forecastle head. In this part of the ship before conversion, there was on the port side an oil and lamp room and on the starboard side the carpenter's shop and store. The principal new work here, therefore, has included the construction of partition bulkheads and the fitting of watertight doors to the two entrances. On the forecastle deck the chief work of interest has been the remarkably ingenious electrification of the steam windlass, which has brought that unit thoroughly into line with the rest of the modern equipment on the ship. More detailed references was made to this work in the article on the TAMPA conversion in December, 1926, MOTORSHIP.

Neglecting for a moment new construction in the wells forward and aft, it is instructive to notice that the bridge deck 'tween deck space has, with the adoption of Diesels, been put to much different use. Originally this space was occupied by, reading from forward, the deep tank hatch, the boiler hatch and engine hatch and, abaft this again, a cold storage space. On the port side aft was a fresh water tank and a bin for boiler gear; on the starboard side a fresh water tank and steward's stores. Here were also six small coaling hatches leading direct to the bunker space below. The whole of this space has now been reconstructed. Engine and boiler hatches are now combined and all bunker hatches have been plated over. A new watertight transverse bulkhead is built across the space about two-thirds of the distance from the fore end of the bridge. All space forward of this is cargo space. Abaft this on the starboard side is a mail room and the space containing the batteries of CO_2 bottles for the Lux fire extinguishing system. On the port side is a baggage room—for passenger's baggage—dry stores, slop chest and butcher's shop. The original cold storage space has been retained and is now divided into separate insulated chambers for outbound and homebound meat and for vegetables. With the elimination of the coal bunker space and the alteration in engine and boiler hatch (this latter occupied on the second deck about two-thirds of beam of the ship) considerable modifications have been possible in the second 'tween deck space. The engine hatch at this level is a comparatively narrow trunkway and advantage has been taken of this to arrange on the port side an ice machine room and a large well-equipped machine shop, with a fresh water tank at the forward end. An interesting feature here is the 2-ton lifting gear which runs fore and aft on an "I" girder attached to the underside of the main deck and serves the independent compressor unit to the main engine through a long narrow hatch opening on the machine shop floor.

On the starboard side of the 'tween decks is a space for two starting air tanks of 365 cu. ft. capacity each. Forward of this again is a cargo space opening directly on to the 'tween deck cargo space outside the machinery space. This forms a useful interchangeable space suitable either for cargo or for machinery stores and spare gear.

Returning now to the main deck, substantially the same alterations have been carried out in the aft well as in the forward well. Considerable ingenuity has been shown, however, in transforming the poop from a crew and steering engine space to a cargo carrying space, unobstructed except for a small contactor house for the warping winch on the break of the poop and a small store in the extreme stern. The poop is closed by watertight doors. The re-arrangement has been accomplished by constructing on the poop deck a rectangular house containing comfortable sleeping quarters, in 2-berth rooms, and necessary washrooms, for 10 seamen and 2 wipers. Abaft this again but attached to the crew house is a narrower house containing the re-arranged steering gear. Note that there is no mess room for the crew in the poop house. This is arranged in the new house on the bridge deck at the aft end. The arrangement is a good one, because it obviates crew's food being carried aft along a wet slippery deck in bad weather, a practice which would not be in conformity with the high standard of accommodation aimed at on most modern American ships.

S. Wiley Wakeman, who has been responsible for the conversion work on the WEST HONAKER *at the Fore River Yard, was, on Nov. 1 last, appointed vice-president and general manager of the Bethlehem Shipbuilding Corporation, Ltd., in charge of the sales and operation of the corporation's activities on the Atlantic Coast. This change was made for the purpose of combining the Bethlehem Shipbuilding activities under one head and to simplify the operation of the East Coast yards. Mr. Wakeman, who was born in Bridgeport, Conn., graduated from Cornell University in* 1899 *with the degree of Mechanical Engineer. He went to the Newport News Sb. & D. D. Co. for* 18 *months and then joined the New York Shipbuilding Corporation at Camden, N. J. During his* 14 *years at that yard his experience covered every phase of shipbuilding activity and embraced an active part in the building of many warships. He was Assistant General Manager there when he left to accept the position of General Superintendent of the Fore Rive Shipbuilding Corporation, Quincy, Mass., where he was given complete supervision of production. When Bethlehem purchased the yard in* 1917 *he was made General Manager there and shortly afterwards the destroyer plant at Squantum, Mass., the boiler plant at Providence, R. I., and the turbine plant at Buffalo, N. Y., were placed under his direction.*

The steering gear is of screw type and the original gear has been retained, modernized and electrified. It is now driven by a 25 hp. Westinghouse motor connected to the shaft through Falk reduction gear and Falk-Bibby flexible coupling. This is substantially the arrangement carried out in TAMPA, but because more space was available in WEST HONAKER a modification, in fact a simplification, has been made in this case. In TAMPA, restrictions of space made it necessary to arrange the motor at 90 deg. to the shaft. The motor and reduction gear were at the forward end of the house. In WEST HONAKER'S arrangement the gear and motor have been turned through 180 deg. This has necessitated a slight re-arrangement of the hand and emergency steering position on the docking bridge on top of the poop house. Here are an ordinary magnetic compass, the large twin hand wheels which can operate the screw gear direct, and the Westinghouse non-follow up rudder controller (this is just like a street car controller and is part of the electro-navigational, which includes equipment comprising master gyro-compass, repeater and "metal mike," installed in the ship). The poop position also has a Sperry rudder angle indicator mounted separately from the rudder controller and not on the same pedestal as in ms. TAMPA.

MS. WEST HONAKER has virtually a repetition of TAMPA'S cargo handling appliances. There are four Lidgerwood electric winches in each of the wells, and considerable improvement has been made on the old steam arrangement, not only in the substitution of electricity for steam, but also in raising the winches on winch houses round each mast clear of the deck. This is a valuable point which is often surprisingly neglected in freighters. It certainly involves extra expense, but this in time is saved by quicker turn round in port due to quicker handling of the cargo with the winches clear for operation. Controllers are tucked away inside a small house which does not occupy the whole length of the superstructure. Motion is transmitted from the winch tender to the controller by means of a lever on a pedestal, clear from the winches, and rods. Weight and cost have been saved in the construction of these winch houses by making the closed-in portion, which houses the controllers and acts as a deck store, smaller than the house deck. The "overhang" so formed is supported by light pillars and vertical semi-circular plates at the corners. Four winches in each well take care of four 5-ton wooden booms in each well. There is in addition a 30-ton steel boom for heavy cargo attached to the foremast. The deep tank has two 3-ton booms on king posts served by winches on the superstructure deck.

Conversion work in the wells may be summarized as having included the construction of winch houses, the installation of electric winches, and the alteration in position of the boom heels and their attachment to the mast.

Amidships the former houses on the bridge deck have been entirely recon-

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U. S. S. B. Motorship West Honaker, Converted by Bethlehem Shipbuilding Corporation, Engined by McIntosh & Seymour

Item	Name of Unit	No. of Units	Make	Description and Characteristics
	Propelling Equipment			
1	Main engine	1	McIntosh & Seymour	2700 b.hp. 4-cycle single-acting, 6 cylinders 32 in. x 60 in., 95 r.p.m., with independent compressor.
2	Injection air flask	3	McIntosh & Seymour	16¾ cu. ft. capacity each (one service, two reserve).
3	Maneuvering-air tank	2	N. N. Sbdg. & D. D. Co.	550 cu. ft. each 6 ft. diameter, 20 ft. 8 in. long, working pressure 400 lb. per sq. in.
4	Exhaust line and muffler	1	Bethlehem Sbdg. Co.	22 in. diameter Armco iron built-up pipe, slip joint at each end, lagged with 2½ in. insulation from water cooled manifold on engine to Maxim silencer in stack and 22 in. outlet to atmosphere.
5	Thrust bearing	1	Kingsbury	32 in. diameter.
6	Shaft	1	———	15½ in. diameter new thrustshaft, 14½ in. diameter old lineshaft, 16 in. diameter old propeller shaft.
7	Stern tube	1	———	Original cast iron stern tube lined with lignum vitae, water lubrication, brass liners on tailshaft in way of stern tube bearing.
8	Propeller	1	———	Manganese bronze 4-bladed, built up, 17 ft. 0 in. diameter, 13 ft. 6 in. pitch, 81.75 sq. in. projected area, 93 sq. in. developed area, 226.98 sq. in. disc area, 0.795 pitch ratio, 0.36 projected ratio, 0.41 developed area ratio; rake of blades 15 in. at tip.
	Auxiliary Power Equipment			
9	Independent compressor and generator set	1	McIntosh & Seymour-Ridgway	400 b.hp. 4-cycle air-injection engine, 4 cylinders 17 in. x 24 in., 200 r.p.m., direct connected with three 3-stage compressors supplying injection air for this unit and for the main engine, and direct connected also with 75 kw. 240 volt d.c. generator.
10	Generator and auxiliary compressor set	2	McIntosh & Seymour-Ridgway	75 kw. 240 volt d.c. generator, direct connected with 108 b.hp. 4 cycle air-injection engine, 2 cylinders 13⅝ in. x 18 in., 275 r.p.m. and with 3-stage oversize compressor having excess capacity of 170 cu. ft. of free air per min.
11	Injection air flask	3	McIntosh & Seymour	One for independent compressor set and one for each auxiliary generator and compressor set.
12	Starting air tank	2	———	Air taken from main maneuvering air tanks, located on 2nd deck.
13	Exhaust line and muffler	3	Bethlehem Sbdg.-Maxim	Each of the three engine sets has an exhaust pipe led through Maxim silencer, from which a steel pipe with 2½ in. insulation leads to atmosphere through stack.
14	Port lighting and pilot compressor set	1	Mianus-Diehl-Rix	14 kw. 240 volt d.c. generator, direct connected with 22 b.hp. 2-cycle airless-injection engine, 3 cylinders 5 5/16 in. x 7⅛ in., 550 r.p.m. and direct connected also with Rix air compressor of capacity of 14½ cu. ft. of free air per min. to 1000 lb. per sq. in. Hand compressor available for starting when ship's air-tanks are all empty.
15	Switchboard	1	Walker	4 generator panels, 2 lighting and low power panels, 2 testing panels, 3 duplex motor starting panels and 5 single motor starting panels.
	Pump Equipment			
16	Salt water cooling and general service pump	2	Nash-G.E.	750 g.p.m. at 35 lb. per sq. in., self-priming centrifugal, 8 in. suction, 6 in. discharge, 30 hp. motor.
17	Fire and bilge pump	1	Nash-G.E.	200 g.p.m. at 100 lb. per sq. in., self-priming centrifugal, 4 in. suction, 3 in. discharge, 20 hp. motor.
18	Engine room bilge pump	1	Nash-G.E.	300 g.p.m. at 20 lb. per sq. in., self-priming centrifugal, 5 in. suction, 4 in. discharge, 7½ hp. motor.
19	Sanitary pump	1	Nash-G.E.	70 g.p.m. at 55 lb. per sq. in., centrifugal, 3 in. suction, 2 in. discharge, 7½ hp. motor.
20	Fresh water (washing) pump	1	Nash-G.E.	70 g.p.m. at 55 lb. per sq. in., centrifugal, 3 in. suction, 2 in. discharge, 7½ hp. motor.
21	Fresh water (drinking) pump	1	Nash-G.E.	35 g.p.m. at 30 lb. per sq. in., centrifugal, 3 in. suction, 2 in. discharge, driven by 7½ hp. motor.
22	Lub. oil circulating pump	2	Kinney-G.E.	150 g.p.m. at 30 lb. per sq. in., rotary, 4 in. suction, 4 in. discharge, 7½ hp. motor driving through Falk flexible coupling and reduction gear.
23	Fuel transfer pump	1	Kinney-G.E.	150 g.p.m. at 30 lb. per sq. in., rotary, 4 in. suction, 4 in. discharge, 7½ hp. motor driving through Falk coupling and reduction gear.
24	Lub. oil hand pump	1	Rumsey	Semi-rotary force pump, 1¼ in. suction and discharge.
25	Fuel hand pump	1	Rumsey	Semi-rotary force pump, 1¼ in. suction and discharge.
26	Fire hand pump	2	Douglas	6 in. x 5½ in. double-acting force pump, 2½ in. discharge.
	Fuel Oil Service			
27	Storage tanks—double bottom	9	———	885.5 tons total capacity, fitted with 1½ in. heating coils near pump suctions.
28	Raw fuel oil tank	1	———	17½ tons capacity, with 2 heating coils, each 10 sq. ft. surface.
29	Purified oil tank	1	———	26.8 tons capacity, with 2 heating coils, each 10 sq. ft. surface.
30	Fuel oil centrifuge	2	Sharples	Pressure type, capacity 300 gal. per hr.
31	Daily service tank	2	Bethlehem Sbdg. Corp.	14 tons total capacity, with 9 sq. ft. heating coil surface in each tank.
32	Kerosene oil tank	2	Bethlehem Sbdg. Corp.	100 gal. each, for emergency starting in extremely cold weather and for cleaning valves.
33	Catch-all tank	1	Bethlehem Sbdg. Corp.	150 gal. capacity, for drains from drip pans.
	Lub. Oil Service			
34	Lub. oil sump tank	2	Bethlehem Sbdg. Corp.	4600 gal. total capacity; 9 sq. ft. surface of heating coil near pump suction in each tank.
35	Lub. oil purifier	1	Sharples	Open type, capacity 150 gal. per hr.
36	Cylinder oil tank	2	Bethlehem Sbdg. Corp.	1100 gal. capacity total.
37	Compressor oil tank	1	Bethlehem Sbdg. Corp.	210 gal. capacity.
38	Lub. oil drain tank	3	Bethlehem Sbdg. Corp.	One of 225 gal. capacity for independent compressor engine, and two of 135 gal. capacity, each for the 2 generator compressor sets.
39	Dirty lub. oil tank	1	Bethlehem Sbdg. Corp.	225 gal. capacity, for used oil from engines of generator and compressor sets for centrifuging.

(*Continued on page* 22)

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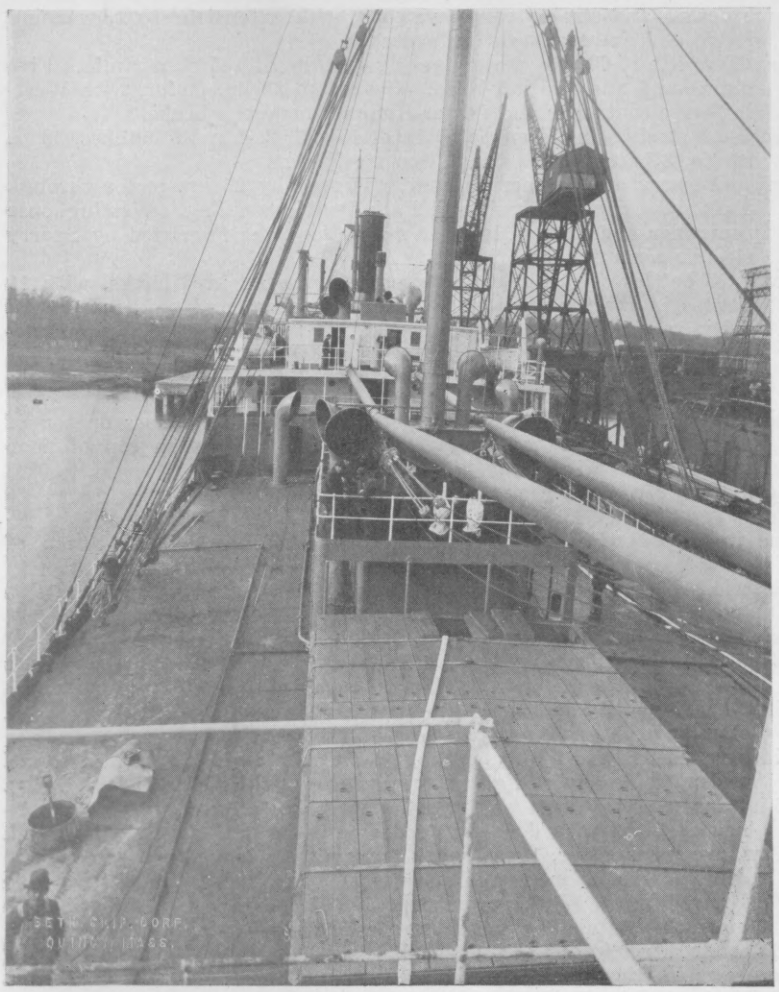
structed. Formerly the arrangement was that of the stereotyped three island cargo vessel with one house at the forward end containing navigating officers' accommodations and saloon; above this was the captain's house, and above this again the pilot and chart house. Abaft this was a clear deck space with deep tank hatch and two winches. This was entirely open as far as the sidehouses round the engine casing, containing engineers' accommodation and mess room and galley. On top of this at the aft end was a radio house.

The whole of this has now been rebuilt to contain comfortable quarters for 14 passengers, in addition to a large dining saloon, bath rooms and offices, accommodations for deck and engineer officers, stewards, and petty officers. There is also a petty officers' mess, an officers' mess, and a crew's mess, all served in addition to the passenger's saloon by a large well-equipped galley with oil burning ranges. The house tops have been converted into a wide spacious deck with radio room and hospital in a wooden structure aft. The engine room skylight is mounted on a steel structure in this deck raised about 2 ft. 6 in. above the deck level and not flush as in ms. TAMPA. There is, also on the starboard side, a non-watertight hatch with a vertical ladder leading directly down into the engine room. At the forward end is the square muffler house surmounted by a stumpy characteristic stack 5 ft. 0 in. diameter, at the fore edge of which is a Sperry visible whistle. The audible part works by compressed air, while the visible part is a powerful electric light. The muffler house contains a Maxim muffler from the main 2700 hp. Diesel and the exhaust pipes—one 10 in. and two 8 in.—

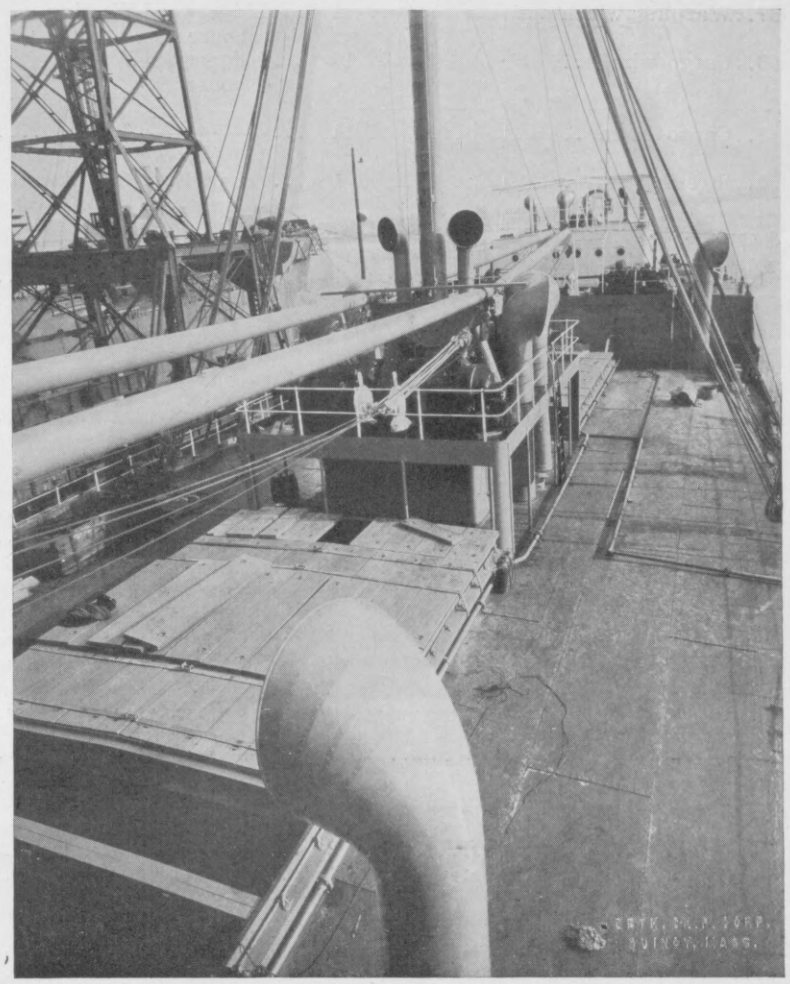
Sperry electric flasher on the whistle

from the auxiliary Diesels. The mufflers for the auxiliary Diesels are arranged horizontally under the deck.

The biggest constructional work in the rearrangement of the big bridge deck house has been the linking up of the original house at the fore end—the deck officers' house we may term it—with the engineer officers' house. This has entailed the construction of new sides with frames, side plating, deck beams and deck plating, with pitch pine wooden decking above. The deep tank hatch had to be trunked up to the new superstructure deck and the king posts were also lengthened so as to operate the two 3-ton booms in their new position. Considerable ingenuity was exercised in the constructional work and existing material has been worked into the picture wherever possible. For example, the existing hatch coamings have been extended upwards by suitable attachments for the next strake of plating. The 14 passengers' accommodations are arranged in what was actually the old house. This, incidentally, is run out flush with the bridge end and differs thus from TAMPA's house, round the front of which there is a walkway. There are four comfortable 2-berth cabins and two 3-berth cabins. They are all extremely well fitted and passengers who travel in the Shipping Board's new motorships must inevitably contrast them favorably with many ocean passenger liners. Abaft the passenger house is new construction with, on the port side, a roomy dining saloon for passengers and, on the starboard side a commodious stateroom and office for the chief engineer. Here is the trunkway to the deep tank, and the space between the aft edge of the hatch and the forward end of the original casing is taken up on the port side by the gyro-compass-room and on the starboard side by the boat deck winch control apparatus, petty officers' toilet and shower bath. Engineers and motormen are accommodated in cabins on the starboard side at the aft end of the house. In the corresponding position on the starboard side is accommodation for stewards, cooks and messmen, while here is also a common mess for deck and engineer officers and a mess for petty officers. The crew's mess, as has been mentioned, is arranged athwartships at the aft end of this house—easy of access from the poop.



Looking forward from the poop on West Honaker



Looking aft from the bridge on West Honaker

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U.S.S.B. Motorship West Honaker, Converted by Bethlehem S. B. Corp., Engined by McIntosh & Seymour

(Continued from page 20)

Item	Name of Unit	No. of Units	Make	Description and Characteristics
	Misc. Oil Service			
40.	Galley range tank	1	Bethlehem Sbdg. Corp.	215 gal. capacity with heating coil; gravity tank above galley.
	Lifting Gear			
41.	Traveling crane	1	Brownhoist	8-ton hand operated, with two 4-wheel, 4-ton Yale & Towne combined chain blocks and trolleys, over the main engine.
42.	Geared trolley	3	Wright	4-wheel, 2 tons combined chain block and trolley on I-beam over each generator set.
	Machine Shop			
43.	Machine tools	3	See next column	Lathe, drill press and grinding wheel stand, with line shafting driven by a 7½ hp. G. E. motor, located in workshop on 2nd deck.
	Heating Equipment			
44.	Heating boiler	1	Bethlehem Sbdg. Corp.	Vertical, 4 ft. 0 in. diameter, 11 ft. 8 in. high, 173 sq. ft. heating surface total, working pressure 110 lb. per sq. in., Sunbeam oil burner.
45.	Boiler feed pump	1	Worthington	3 in. x 2 in. x 3 in. horizontal duplex.
46.	Hot well tank	1	————	156 gal. capacity, with float for automatic control of feed pump.
47.	Vacuum pump	1	Worthington	5½ in. x 8 in. x 7 in. horizontal simplex, for steam return lines from oil tank heating coils.
48.	Evaporator	1	Griscom-Russell	25 tons capacity.
49.	Drinking water still	1	Jewell	25 gal. capacity.
50.	Hot fresh water tank	1	————	100 gal. capacity, located in galley.
51.	Fresh water heater	2	Sepco	One of 3000 watts in hot fresh water tank of 100 gal. capacity amidships. One of 1500 watts in 15 gal. tank for crew's washroom.
52.	Electric steam radiator	1	Sepco	1000 watts capacity for carpenter shop.
	Refrigerating Service			
53.	Ice machine	1	York-Diehl	2-tons capacity, direct expansion ammonia compressor, 2-cylinders 4 in. x 4 in. single-acting, 275 r.p.m., direct connected with 7½ hp. Diehl motor through Clark flexible coupling.
54.	Cooling coils	3	York	Meat room 10 deg. Fahr., 758 cu. ft., 365 linear ft. 1¼ in. pipe. Meat room 0 deg. Fahr., 887 cu. ft., 593 linear ft. 1¼ in. pipe. Vegetable room 24 deg. Fahr., 538 cu. ft., 230 linear ft. 1¼ in. pipe.
55.	Cork insulation	—	Armstrong Cork Co.	Two layers of blocks, each 3 in. thick, on floor; 8 in. layer granulated round sides and 10 in. layer granulated on top.
	Deck & Hold Equipment			
56.	Anchor windlass	1	————	Original 2¼ in. stud link cable steam windlass converted to electric drive. Now operated by Westinghouse motor of 45 hp. at 450 r.p.m., with Westinghouse controller and Cutler-Hammer magnetic brake.
57.	Warping winch	1	Lidgerwood-Westinghouse	Same design and size as cargo winches, with extension shaft, warping heads and outboard bearing pedestals.
58.	Cargo winch	10	Lidgerwood-Westinghouse	Maximum lift 10,000 lb., normal rating 4000 lb. at 185 ft. per min. Five right-hand and five left-hand. Geared to 25 hp. motor, with Westinghouse controller and Cutler-Hammer magnetic brake.
59.	Cargo boom	11	————	Ten 5-ton steel booms. Length 50 ft. at Nos. 1, 2, 4 and 5 hatches, 32 ft. at No. 3 hatch. Also one 30-ton steel boom.
60.	Steering gear	1	Amer. Eng. Co.-Westinghouse	Original screw steam steering gear, operated by 25 hp. motor through Falk reduction gear unit and Falk flexible coupling. Westinghouse controller and Cutler-Hammer magnetic brake regulated by Sperry electric control from bridge.
61.	Fire extinguishing system	1	Lux CO_2	Total 77 bottles of 50 lb. capacity each, arranged in 6 banks, with 10 bottles in reserve and one each in lamproom and paintroom. All 6 banks (65 bottles) can be discharged into engine room simultaneously or into cargo compartments separately.
	Navigation Equipment			
62.	Magnetic compasses	3	See next column	Hand in wheelhouse; Ritchie (navy type) standard compass on top of wheelhouse; Hand at emergency steering station on top of poop house.
63.	Gyro compass	1	Sperry	Mark VIII, Model 2. Repeater at gyro-pilot.
64.	Gyro-pilot	1	Sperry	2-unit type. Mark IV, Model 3.
65.	Rudder indicator	2	Sperry	One in wheelhouse and one at emergency steering station on top of poop house.
66.	Emergency steering	2	Westinghouse & Amer. Eng. Co.	Electric steering stand with non-follow-up control (Westinghouse) on top of poop house. Hand steering at same station.
67.	Mechanical telegraph	2	Cory	Transmitters port and starboard on bridge; indicator in engine room.
68.	Telephone	5	Henschel	Pilot house to stations in captain's office, radio room, chief engineer's office, engine room and steering engine room.
69.	Speaking tube	5	Cory	Pilot house to engine room, captain's stateroom, gyro compass room, standard compass and from chief's stateroom to engine room.
70.	Navigation and signal lights	5	————	Sidelights, masthead light and range light with G. E. Co. tell-tale panel and portable anchor light, also blinker signal light with Morse Key.
71.	Searchlight	1	Sperry	18-in. incandescent type on top of wheelhouse with control in wheelhouse; fitted with defocussing device to permit use as a floodlight.
72.	Radio	2	Independent Wireless	2 kw. arc transmitter, 1 kw. spark transmitter; Navy type receiver.
73.	Whistle	1	Sperry	8-in. air whistle Tyfon type with attached flashing lamp of 250 watts in Fresnel lens. Working pressure 100 lb. per sq. in., obtained from maneuvering air tanks through Leslie reducing valve.
74.	Fire detector	1	Rich	16 detector lines in cabinet in pilot house.
75.	Submarine signal apparatus	1	Submarine Signal Co.	Receivers in wheelhouse.
76.	Patent log	1	Walker Cherub	Works from taffrail aft.
77.	Sounding machine	1	Freule	Wire-reel type on port side aft on poop.

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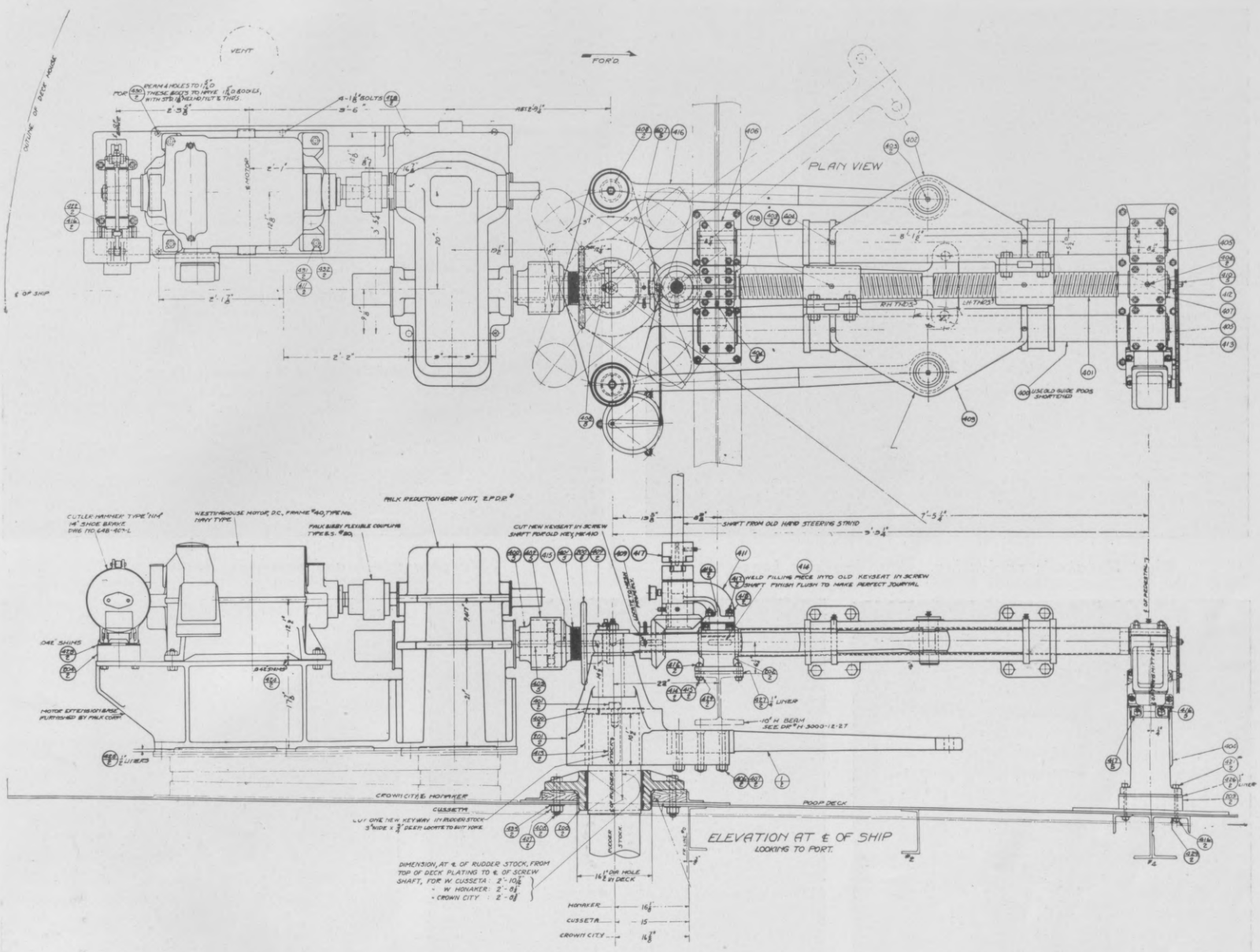
PLAN VIEW
ELEVATION AT ℄ OF SHIP
LOOKING TO PORT.
CUTLER-HAMMER TYPE "H14" 14" SHOE BRAKE
WESTINGHOUSE MOTOR, D.C., FRAME "440", TYPE MH, NAVY TYPE.
FALK REDUCTION GEAR UNIT, E.P.D.P.
FALK BABBY FLEXIBLE COUPLING TYPE B.S. "80"
CUT NEW KEYSEAT IN SCREW SHAFT FOR OLD KEY, MK 410
SHAFT FROM OLD HAND STEERING STAND
WELD FILLING PIECE INTO OLD KEYSEAT IN SCREW SHAFT. FINISH FLUSH TO MAKE PERFECT JOURNAL
MOTOR EXTENSION BASE FURNISHED BY FALK CORP.
10" H BEAM SEE DR. "H 3000-12-27
POOP DECK
CROWN CITY & HOFFMAYER
CUSSETA
CUT ONE NEW KEYWAY IN RUDDER STOCK 3" WIDE × 3/4" DEEP. LOCATE TO SUIT YOKE.
DIMENSION, AT ℄ OF RUDDER STOCK, FROM TOP OF DECK PLATING TO ℄ OF SCREW SHAFT, FOR W. CUSSETA: 2'-10 1/2"
W. HONAKER: 2'-8 1/2"
CROWN CITY: 2'-0"
OUTLINE OF DECK HOUSE
VENT
FOR'D
℄ OF SHIP
RATHER'S
LATHES'

Electrified arrangement of West Honaker's original steam operated screw steering gear—a conversion accomplished very inexpensively

All the navigating officers as well as the captain are accommodated in a house at the forward end of and flush with the end of the new boat deck. The captain has a large room and office on the starboard side. This house is new construction. On its top is arranged the original wooden structure containing the pilot house and chart room. This is now further aft than it was on the steamer owing to the extra space given by the new officers' house. The pilot house, which is much narrower than that on ms. TAMPA, contains the Sperry gyro-pilot unit, which is a duplicate of that fitted on TAMPA, a magnetic compass, a rudder angle indicator, the Lux Rich fire detecting unit, speaking tubes and telephones. Two mechanical telegraphs to the engine room are outside the pilot house on either side. A useful improvement to the bridge is the arrangement of side houses, which are helpful to officers on watch on long ocean passages. There are an 18 in. searchlight on top of the pilot house, a magnetic compass and a speaking tube to the pilot house below.

Comparison of West Honaker as Steamer and as Motorship

	STEAMER	MOTORSHIP
Gross register	5376 tons	5428 tons
Net register	3343 tons	3374 tons
Displacement (load)	12086 tons	12086 tons
Endurance on inner bottom tanks	7300 miles	17600 miles
Total deadweight capacity	8366 tons	8006 tons
Fuel oil	.....	.....
Lubricating oil	360 gal.	3970 gal.
Fresh water	243 tons	214 tons
CARGO DEADWEIGHT CAPACITY (full endurance)	.... tons	.... tons
CARGO DEADWEIGHT CAPACITY (half endurance)	.... tons	.... tons
Power—main engine	2700 s.hp.	3500 i.hp.
Service speed (about)	10.5 knots	11 knots
Gain of time on full endurance	.....	.... days
Passenger accommodation	none	14

The main McIntosh & Seymour single-acting 4-cycle 6-cylinder Diesel develops 2700 b.hp. at 95 r.p.m. and is direct coupled to a 4-blade 17 ft. 0 in. diameter 13 ft. 6 in. pitch manganese bronze propeller. The original line shaft and tail shaft have been used and only a new 15½ in. diameter thrust shaft fitted. The whole line of shafting is now horizontal, while originally it was raked. The same bearings are used on new bases; the stern frame aperture has been rebored and rebushed. No alteration to the height of the shaft tunnel has been necessary, as was the case with ms. TAMPA. The main engine and auxiliary machinery are arranged as shown in the sketch plan on page 25. The engine is mounted on specially constructed foundations, which have been very strongly constructed. The general arrangement of members and scantlings is shown in the sketch. The two first intercostal longitudinal girders on either side of the vertical center keel have been extended vertically and the extensions connected to the tank top by angle bars. Like the intercostals of which they now really form part, the vertical extensions are intercostal to strong web frames attached to the tank top by angle bars and edge stiffened in the same way. Heavy fore and aft plates on the top of this structure actually take the engine. The whole structure is adequately strong fore and aft and efficiently attached to the ship's structure.

The whole of the deck and engine room auxiliary equipment is electrically con-

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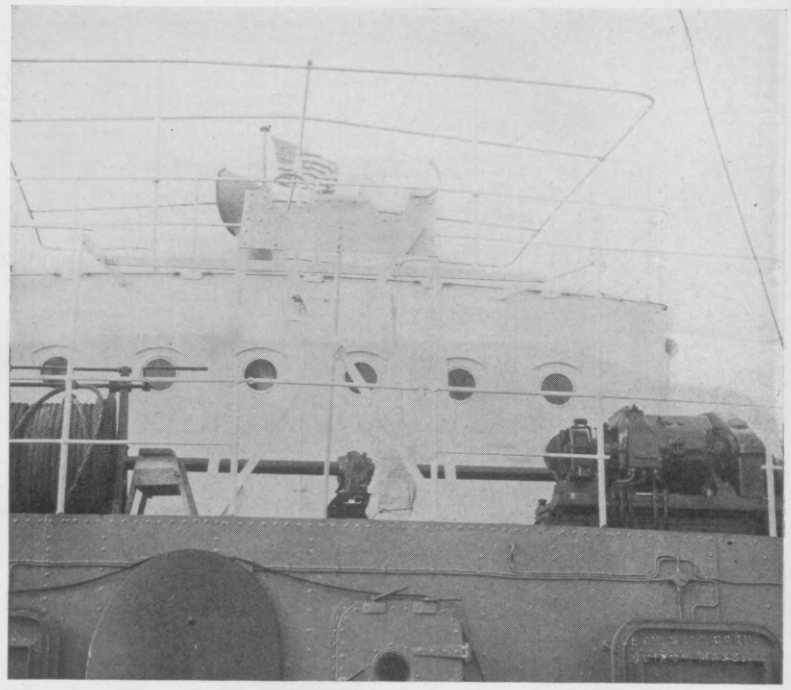
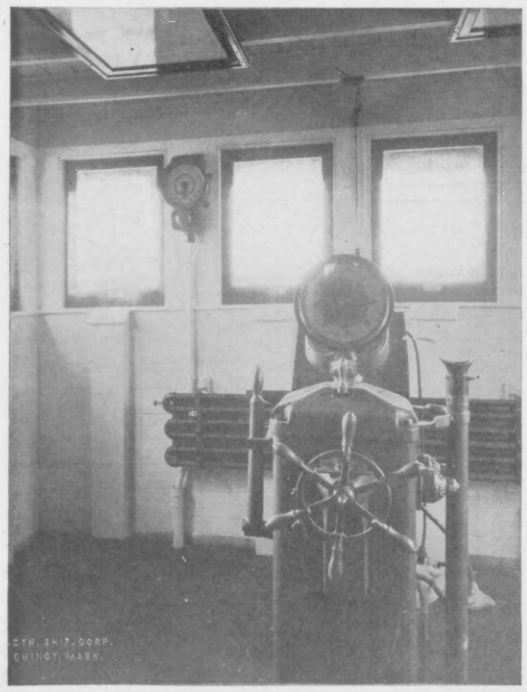
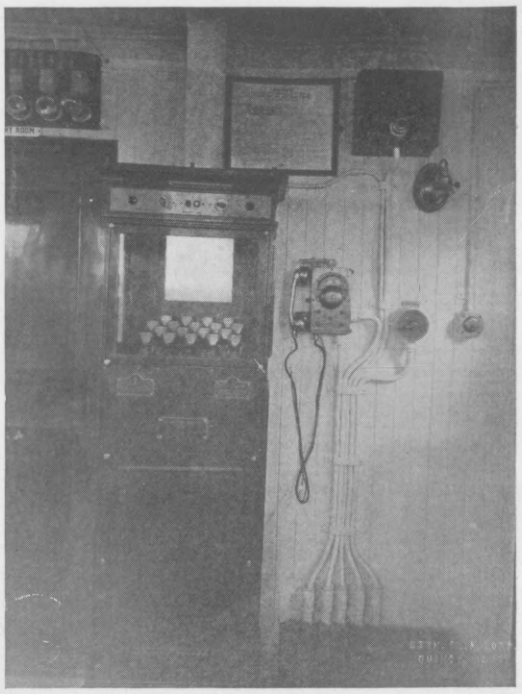
West Honaker's navigating bridge has side houses



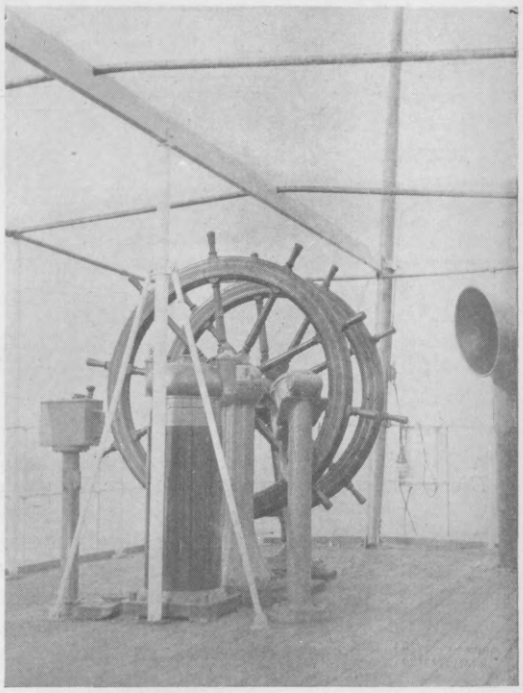
Warping winch and poophouse looking aft



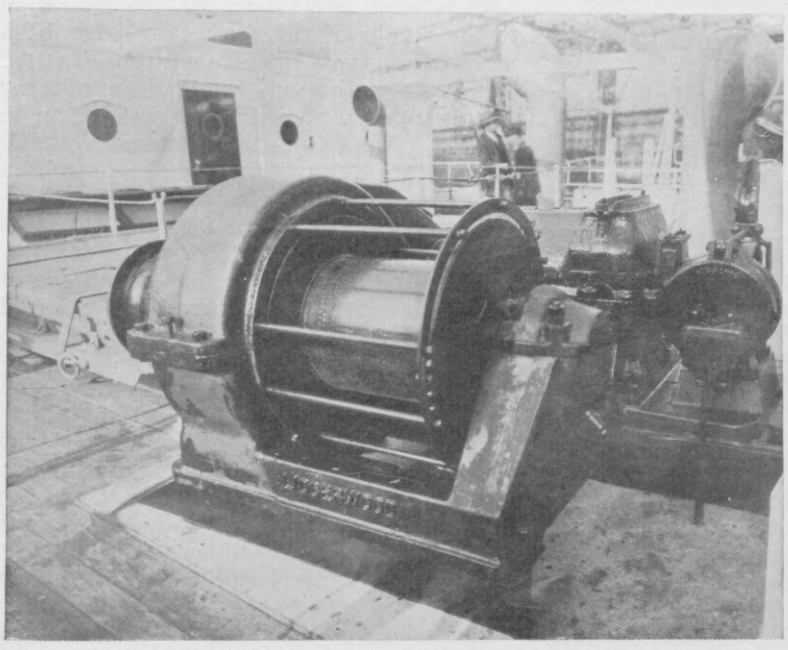
Metal mike in the wheelhouse



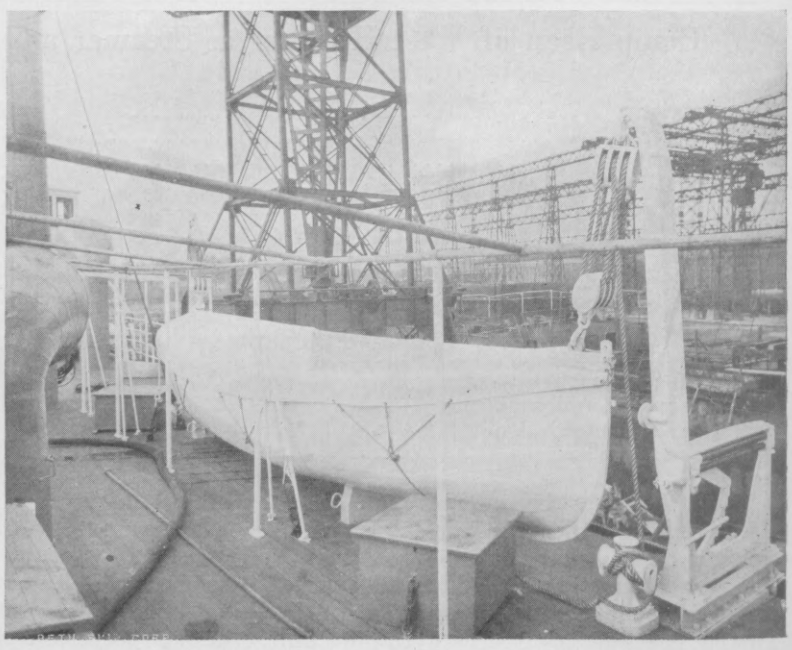
Fire detector cabinet in wheelhouse



Emergency steering on poophouse



Electric winch at No. 3 hatch on boat deck



One of the lifeboats and Welin davits

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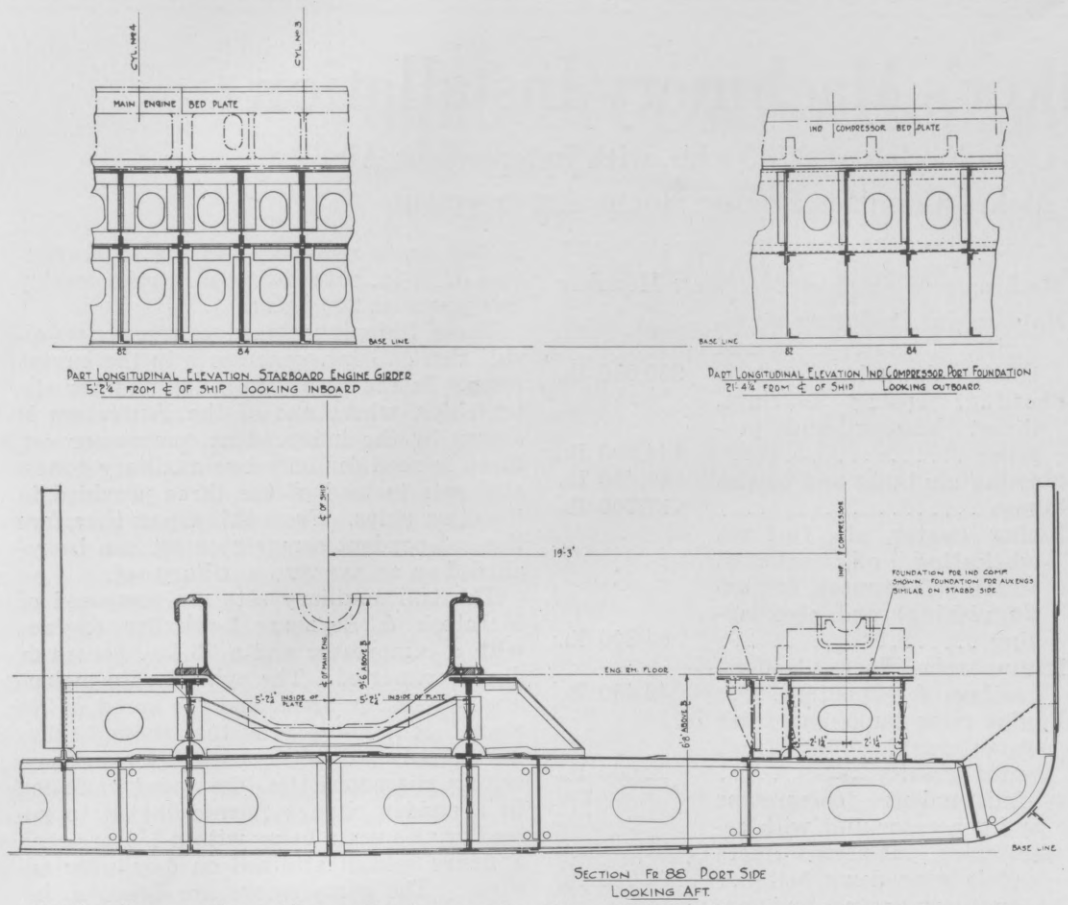
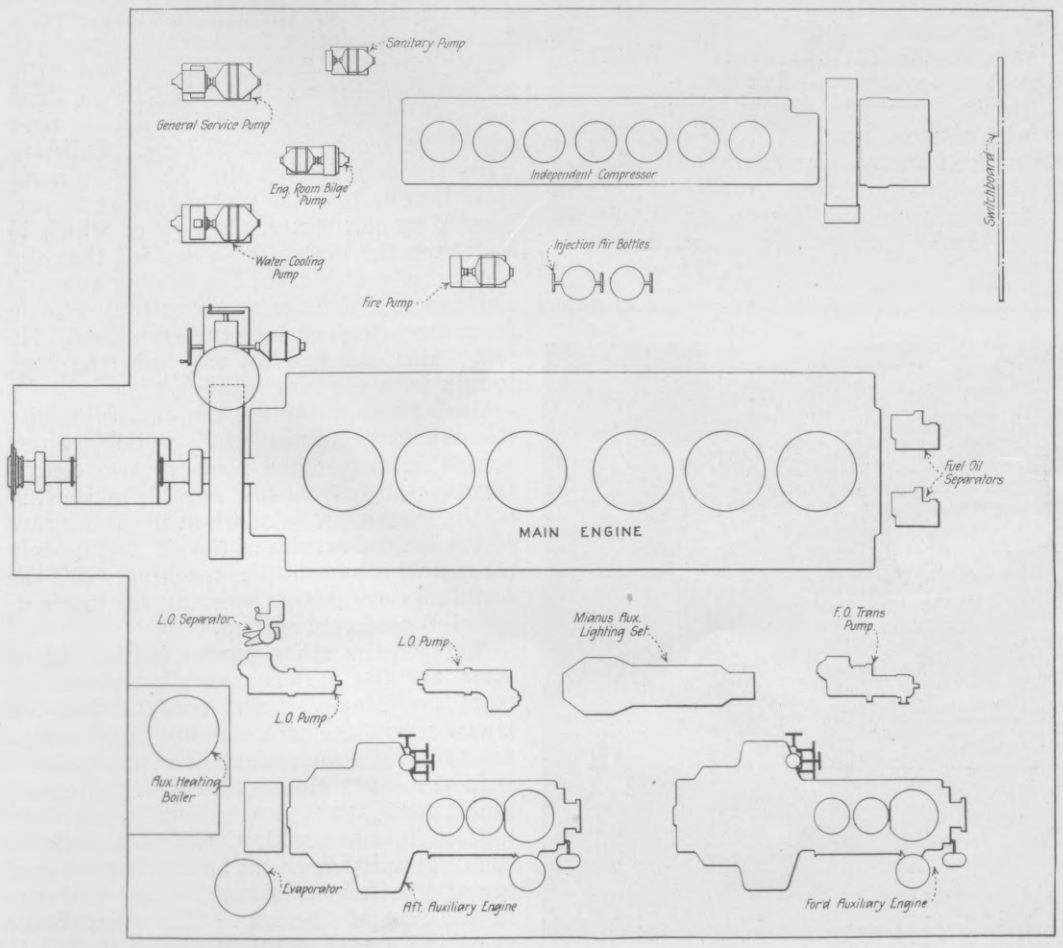

CYL. NO 4
CYL. NO 3
MAIN ENGINE BED PLATE
BASE LINE
PART LONGITUDINAL ELEVATION STARBOARD ENGINE GIRDER
5'-2¼" FROM ℄ OF SHIP LOOKING INBOARD
IND COMPRESSOR BED PLATE
PART LONGITUDINAL ELEVATION IND COMPRESSOR PORT FOUNDATION
21'-4½" FROM ℄ OF SHIP LOOKING OUTBOARD
19'-5"
ENG RM FLOOR
SECTION FR 88 PORT SIDE
LOOKING AFT

Section in way of machinery showing construction which has been adopted to take engines

trolled—WEST HONAKER is in every sense of the word an electric ship—and for supplying current for this purpose there are three generators of 75 kw. output, one of which is connected to a 4-cylinder McIntosh & Seymour Diesel rated for 400 b.hp. at 200 r.p.m in common with 3-stage injection air compressors, while the other two are each driven by a 2-cylinder McIntosh & Seymour Diesel rated at 108 b.hp. at 275 r.p.m. These two units are in tandem on the starboard side of the engine room. The big generator compressor set is in the port side. For a "no air in ship" condition a combined generator-compressor set is fitted, driven by a 22 hp. 2-cycle Diesel.



Diagrammatic layout of West Honaker's machinery space showing principal auxiliary machinery

Electric Heating Equipment

Extensive use is made of electrical heating on all the vessels of the Shipping Board's Conversion Program. WEST HONAKER has the same type of equipment in this respect as all the other ships have. The Shipping Board engineers made an intensive study of the subject and drew up specifications which called for safety features that were not incorporated in any standard equipment formerly on the market. The principal new feature introduced in these specifications is the requirement that none of the heating devices shall be damaged if the water runs off and leaves the container dry.

There are two main groups of heating devices on these ships: (1) the fresh water heaters for the service of baths and wash basins, and (2) the heaters for the galley service and table service. In the first group each ship has two units, both automatic water heaters, one for the midship quarters and the other for the poop quarters. The former is a big unit of 100 gal. capacity, having to serve the baths for the officers and passengers and the various washbasins in the same quarters that have hot running water. This heater is located in the upper part of the machinery casing and takes a maximum of 4½ kw. The automatic electric water heater for the crew's quarters serves fewer people and is deemed of ample capacity with 15 gal. of water and a maximum heating load of 1½ kw.

This system of automatic electric heating for the washing water will provide a considerable economy in these vessels, where the boiler has no other purpose than to provide steam for the radiators in the living spaces during the short periods when the ships will meet northern winters. On account of this relatively rare need for steam on the boiler the galley can also be more economically served by electrical heating units. The range is of the oil-burner type with a water back, but the other devices are electrical.

A water urn of 15 gal. capacity and a coffee urn of 5 gal. capacity are provided, both specially designed with ample heating elements and providing hot water and hot coffee in the galley at all times. For the dining room service there are electric food warmers, electric plate heaters, etc.

All these devices with Sepco heaters have been supplied by the Automatic Electric Heater Co. to Shipping Board specification. The number of them for all purposes on each ship is 17, including the electric steam radiator installed in the carpenter shop in the forecastle, which could otherwise only have been heated by running a lagged steam pipe right forward at considerable expense and causing considerable waste.

Sperry Whistle Flasher

WEST HONAKER has the same Sperry flashing device attached to her air whistle that made its first appearance on the TAMPA. A picture of it is given on page 21. Every time the whistle is blown the lamp is lighted for the duration of the blast, calling visible attention to the ship emitting the blast and preventing confusion when several ships are approaching. A 250 watt lamp is used in a Fresnel lens, and the light is visible at 2 miles in bright sunshine.

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West Honaker's Machinery Installation

Single-Acting 4-Cycle Engine of 2700 s.hp. with Independent Air Compressor Makes Compact Engine Room Arrangement

IN the WEST HONAKER the Shipping Board engineers have demonstrated that the 4-cycle single-acting engine can be installed in a smaller space than is generally considered possible by providing a separately driven injection air compressor instead of attached compressor. This permits also greater concentration of power on the shafting with a given size engine cylinder. All the types of Diesels being installed permit more power to be employed than the vessel's steam machinery developed in the same space.

A glance at the engine room plan (p 25) discloses how the practice of using an independent compressor set to supply power for a main single-acting engine has been followed in this vessel. It is a practice that has been incorporated in the big installation of double-acting engines in the motorliner GRIPSHOLM and is regarded very favorably by ship's engineers because it enables a full supply of air to be pumped into the maneuvering-air tanks irrespective of the speed of the main engine and is therefore very convenient when the vessel is entering or leaving port.

The 2700 b.hp. McIntosh & Seymour single-acting engine is a 6-cylinder set, with a diameter of 32-in. and with a piston stroke of 60-in., the rated power being developed at 95 r.p.m.

Had the air compressor been arranged on the main engine the shaft horsepower would have been reduced to about 2400 b.hp. which would have corresponded well with the original steam power, but would not have given the extra ship speed desired. It would also have lengthened the engine just an inconvenient amount.

Therefore the compressor was taken care of in an independent engine set, three 3-stage compressors being direct connected with a 4-cylinder McIntosh & Seymour trunk piston engine which is utilized also to drive a 75 kw. generator for sea service. With the additional electric load an engine of 400 hp. is required, and the four cylinders of 17-in. bore and 24-in. stroke develop this power at 200 r.p.m.

These Shipping Board conversions provide three 75 kw. generators in the engine room. In the WEST HONAKER and her sister ships, where one of the generators is driven by the independent compressor set, there is need for only two auxiliary generator sets instead of the three provided in the other ships. From this aspect therefore the independent compressor set can be regarded as an oversize auxiliary set.

The two auxiliary sets are composed of McIntosh & Seymour 2-cylinder engines with a compressor and a 75 kw. generator direct connected. The cylinder dimensions are 13⅝-in. by 18-in. and the speed is 275 r.p.m. It is noteworthy that these 2-cylinder engines exhibit remarkably close governing characteristics, the speed variation in a sudden change from full-load to no-load or vice versa being within 1½ per cent, a figure seldom attained on 6-cylinder engines. The compressors are oversize, being required to assist in replenishing the air tanks when necessary, and the big variation in capacity is obtained by the use of clearance unloaders on each of the stages.

Cylinders and compressors of the independent air compressor set and of the auxiliary engine sets are of a stock McIntosh & Seymour design, except only that the excess air capacity demanded in the auxiliary compressors for occasional use and the small duty required of them in normal service dictated a variation in clearance spaces.

An extended description of the 2700 hp. main engine was published in the June issue of MOTORSHIP, and the details need not therefore be repeated here. Substantially the only feature that has to be made clear here is that the piston cooling is performed by salt water, the flow of which to and from the piston is so devised that the leakage of water from the cooling tubes is confined to a definite space entirely remote from any openings into the crankcase. No salt water can find its way into the base to mix with the lubricating oil.

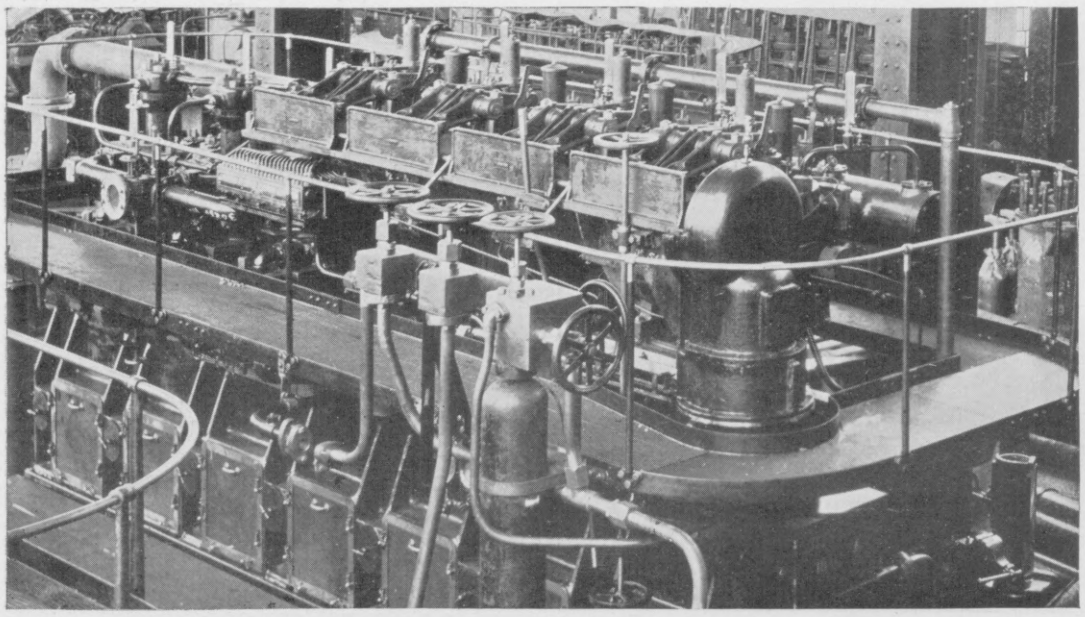
Use of salt water for the engine cooling throughout confines the cooling water pumps in the engine room to two centrifugals, each individually capable of serving all the machinery in addition to taking care of the general service of the ship. The only other pumps serving the machinery are the Kinney rotary pumps assuring the lubricating oil forced feed system.

Most of the other pumps in the engine room are for various ship's purposes, except the Kinney pump for the fuel oil transfer and the two standby hand pumps for fuel and lubricating oil respectively.

In the WEST HONAKER variations of engine room layout are noticed when comparison is made with the TAMPA installation. The change in the location of the generator sets follows of course, the difference in the size of the sets. The switchboard is on the engine room floor, and the workshop is on a flat.

Machinery Weights of Ms. West Honaker

Main engine, including accessories, silencer, liners and holding down bolts	830,000 lb.
Shafting, spring bearings, thrust bearing and propeller	144,800 lb.
Starting air tanks and bottles	63,400 lb.
Pumps	17,700 lb.
Piping (water, air, fuel oil, lubricating oil, exhaust, steam, refrigerator, fire extinguishing) and pipe lagging	84,800 lb.
Engine room floors, ladders, gratings & supports	42,400 lb.
Engine room tanks and fresh water washing and fresh water gravity tanks	22,000 lb.
1—Independent compressor and generator unit with accessories, silencers, liners and holding down bolts	141,700 lb.
2—Auxiliary engines and generator units with accessories, silencers, liners and holding down bolts	103,900 lb.
1—Combined compressor and generator set with accessories, liners and holding down bolts	7,600 lb.
Heating boiler and stack	16,900 lb.
Ice machine and workship tools	9,500 lb.
Electric wiring, switchboard and fixtures	16,400 lb.
Steering gear, windlass and winches	75,000 lb.
Lux-Rich system — bottles (piping weights included with other piping)	12,700 lb.
Other hull engineering items, galley fuel oil tank, vent trunks, coils and lockers	18,000 lb.
Total	1,606,800 lb.
	= 718 long tons.



Independent compressor and generator set of West Honaker—400 b.hp. 4 cylinder engine

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Development of West Honaker's Engine

About 12 Years of Diesel Experience in 50 American Vessels Preceded the Construction of This 2700 b.hp. Engine

By Alfred E. Ballin*

BECAUSE the 4-cycle engine is the type that built the success of the motorship and won for this most modern type of vessel its acceptance by the shipping world, it enjoys a supreme reputation for unquestioned dependability.

That is why the schedule of the Shipping Board for the conversion of 18 steamers into motorships comprised 10 vessels with 4-cycle engines and 8 vessels with engines of other types. The 4-cycle engined ships represented established types; the remaining ships composed the development part of the program. A change has since been made in the ratio of engine types, because one well known firm manufacturing 4-cycle engines finally resolved not to build the group of four main engines awarded to it, and the initial instalment of the Conversion Program was thus reduced to 14 ships.

When we first began to build Diesel engines—it was in 1913—we resisted the alluring promises of the newer undeveloped types and preferred instead to link our established reputation with the proved 4-cycle system. McIntosh & Seymour had been building steam engines for 30 years; some of their first steam engines built in 1885 are still in operation; before the construction of steam engines was suspended at our works we had built them in sizes up to 10,000 hp.; we had obtained steam economies that were remarkable; our reputation was enviable and our desire was to win the same eminence in Diesel construction.

Today we make the same choice as we made in 1913. We adhere to the 4-cycle type because we have made a success of it that has been unexcelled. I do not mean that no other firm has equalled our success; there are several prominent 4-cycle firms whose success has been complete and whose work we admire; but nobody has done better than we have done.

Our continual development has produced a series of all-American engines already built up to 3000 hp. and permitting us to offer a 10,000 b.hp. engine of established design. Since 1914 all our engines have been designed by our own staff in Auburn; the only foreign design we have ever used was the very first one that was put into production at our works, and that was a stationary type. We have built a total of about 600 Diesel engines (stationary as well as marine) aggregating in all almost 400,000 b.hp.

The 2700 b.hp. single-acting engines for the WEST HONAKER, WEST CUSSETA and CROWN CITY embody our experience from a long line of marine installations we have made during the last 10 years. In fact it is interesting to look over the list and see how largely we were instrumental in starting the motorship movement in this country. We have supplied engines for vessels of diverse types as is shown.

* President of the McIntosh & Seymour Corporation.

Back in 1917, when war policies were being evolved and changed over night, McIntosh & Seymour earnestly endeavored to interest the Shipping Board in the Diesel engine as an economic and efficient means of propelling part of the fleet of cargo vessels it then was building in large numbers.

A. E. Ballin, President of the McIntosh & Seymour Corporation, Auburn, N. Y., since 1915 *is one of the leaders of the oil engine industry. Under his administration the old Auburn works have been modernised, many of the old shops replaced by modern buildings and considerable extensions made, one of the most spacious erecting shops in the country now*

being a feature of the plant. Mr. Ballin has been responsible for the development of a very complete line of marine and stationary Diesel engines and has recently added several designs of Diesel locomotive motors. The business has been greatly expanded, and the Corporation today has attained an eminence in the oil engine business similar to that it held when it was one of the leaders of the steam engine industry.

To attract interest under the stress of those times was very difficult, but finally after interviewing a number of the officials and having an opportunity to discuss this matter with their technical associates and going over the general problems involved, we entered into a contract with the Shipping Board covering the building of 52 Diesel engines intended for twin-screw installations.

The engines were of a size which we were in shape to go ahead on and deliver, engines of the same bore and stroke having previously established their successful operation under various conditions.

Ships With McIntosh & Seymour Engines

NAME	TYPE	D.W.C. Tons	POWER B.hp.
9 years old.			
BABINDA	Freighter	4400	1000
BENOWA	Freighter	4400	1000
CETHANA	Freighter	3200	1000
CHALLAMBA	Freighter	3200	1000
CHARLES BROWER	Whaler	1000	300
COOLCHA	Freighter	3328	1000
CULBURRA	Freighter	3350	1000
ILE DE JAVA	Freighter	..	1000
8 years old.			
BAYONNE	Tanker	1750	500
BOOBYALLA	Freighter	4400	1000
DONNA LANE	Freighter	3000	1000
MARYLAND	Freighter	3200	600
PRESIDENTE ALESSANDRI	Freighter	..	1000
TEXACO 146	Tanker	1000	300
TEXACO 147	Tanker	1000	300
7 years old.			
BACOI	Tanker	2600	1000
COCHINCHINE	Freighter	2200	1000
J. F. PENROSE	Tanker	5000	750
KAMCHATKA	Freighter	850	300
LOS ALAMOS	Tanker	5000	1500
OREGON	Freighter	3000	1000
SOLITAIRE	Tanker	4675	1000
6 years old.			
GLENDARUEL	Tanker	3000	1000
KENNECOTT	Freighter	6010	1850
ORMIDALE		3000	1000
5 years old.			
MUNMOTOR	Freighter	4200	925
4 years old.			
MOTOR PRINCESS	Auto Ferry	..	1000
MUNCOVE	Freighter	4125	925
STEELMOTOR	Freighter	2700	750
STEELVENDOR	Freighter	2700	750
TROY SOCONY	Tanker	1840	600
3 years old.			
A. MACKENZIE	Dredge	2000	3150
AMSTERDAM SOCONY	Tanker	1960	700
BOSTON SOCONY	Tanker	1960	700
BURLINGTON SOCONY	Tanker	1960	700
DAN C. KINGMAN	Dredge	2000	3150
HARTFORD SOCONY	Tanker	1960	700
J. H. SENIOR	Tanker	1560	700
OSWEGO SOCONY	Tanker	1960	700
PROVIDENCE SOCONY	Tanker	1960	700
ROME SOCONY	Tanker	1960	700
SCHENECTADY SOCONY	Tanker	1960	700
W. L. MARSHAL	Dredge	2000	3150
W. T. ROSSEL	Dredge	2000	3150
DIESEL	Dredge	..	1610
BOOSTER	Dredge	..	800
2 years old.			
C. B. HARRIS	Dredge	..	1450
CLACKAMAS	Dredge	..	3400
NEW YORK	Dredge	..	2300
NORFOLK	Dredge	..	2200
Less than 1 year old.			
RAYMOND	Dredge	..	2800
WEST HONAKER	Freighter	8006	2700

The number of engines involved in that initial contract with the Board was based

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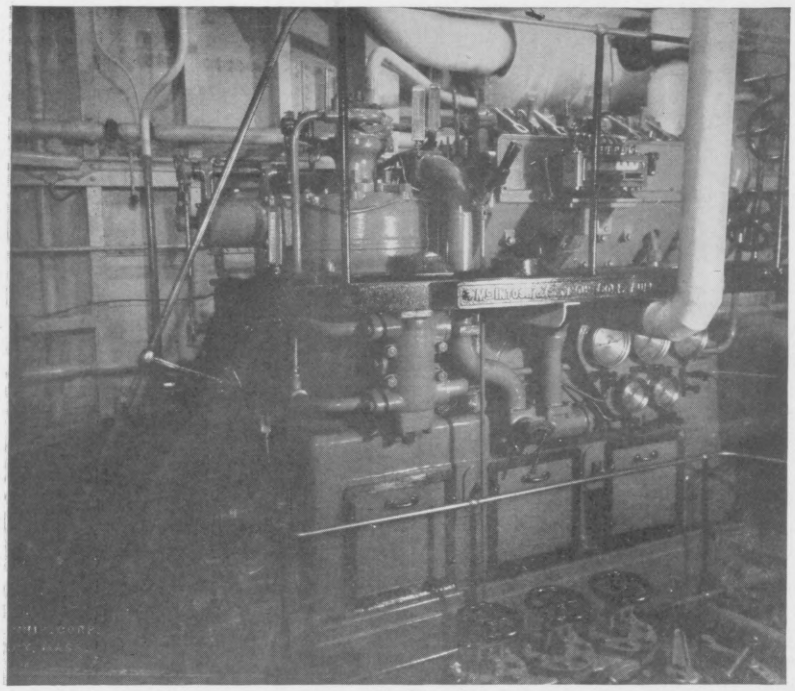
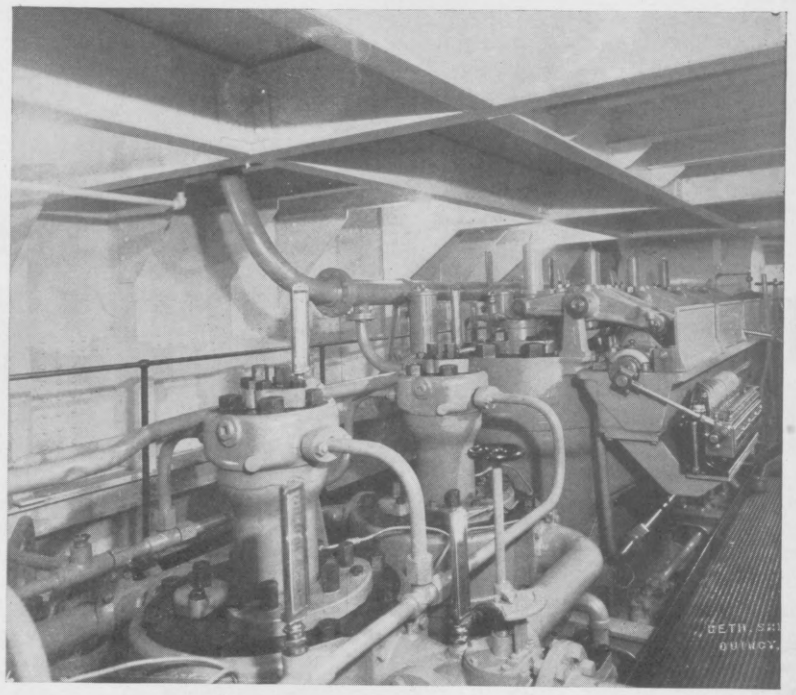
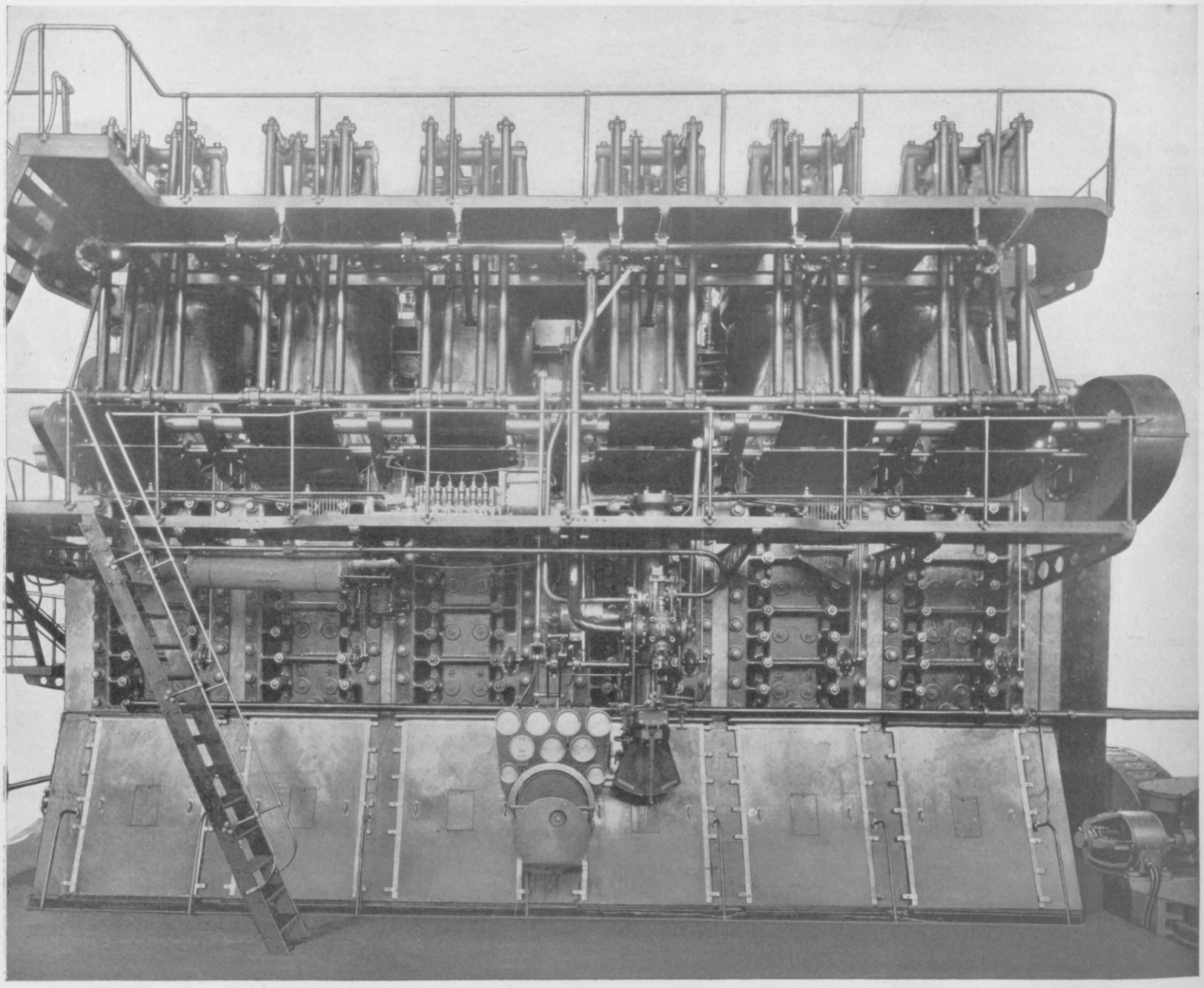


One of two Diesel generator sets on starboard side



Compressors supplying main engine—No. 1 compressor not visible



McIntosh & Seymour 6-cylinder 2700 b.hp. single-acting 4-cycle Diesel engine for the U. S. S. B. motorship West Honaker

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on the estimated output of our shops for 12 months, and it was intimated to us that a further program would be planned, requiring larger units and in greater numbers, which led us to increase our capacity very materially by extensions to the plant.

Unfortunately, however, no ships were provided or allocated for the installation of these engines, and eventually, after the Armistice was signed, the adjusted contract provided for the delivery of 26 of these 52 engines to storage at the Hog Island Yard. Since that time these engines have been withdrawn, and it is interesting to note that they are all now in successful service in various fields.

Two of them are in vessels owned by the Munson Line, the MUNMOTOR and MUNCOVE; two are installed in the Standard Oil Co. of New York tanker LOS ALAMOS; two are installed in the Isthmian Line (U. S. Steel Corporation) vessels STEELMOTOR and STEELVENDOR; one was installed in the J. F. PENROSE of the National Oil Co.; two were placed in the motorship KENNECOTT; two were used on the Port of Portland dredge CLACKAMAS; one was converted to a stationary installation, and the balance were allocated and used for the War Department's sea-going hopper dredges ROSSEL, MACKENZIE, KINGMAN and MARSHAL, and the river dredge C. B. HARRIS.

When the Shipping Board undertook to start the Diesel Conversion Program, McIntosh & Seymour submitted bids on single-acting engines, representing their successful development of many years in sizes approximately up to the dimensions of the three engines now being installed in the WEST HONAKER, the WEST CUSSETA and the CROWN CITY.

It was a safe plan for us to offer a product which we had fully developed and which was available without the slightest risk of any kind to this Department of our Government. We stood willing and ready to guarantee the successful operation of these engines in any way in which the Shipping Board felt justified in demanding.

About that time, however, we found a growing desire on the part of many of the officials of the Government to obtain engines in these large sizes of less weight per horsepower and occupying less space fore and aft in the ship. In consequence, we proposed for this particular need a double-acting 4-cycle engine of 4 cylinders with an attached compressor, developing the same horsepower as the single-acting engine at the same speed, with a consequent reduction in weight per horsepower and in space fore and aft.

As the problems involved in the construction of a double-acting 4-cycle engine are relatively so simple, for it requires substantially only this extra, that a lower head of practically the same design as the upper one be incorporated—using the same valves and operating mechanism — this company felt fully justified in proposing and guaranteeing the successful performance of such an engine for the service of the Shipping Board.

A contract covering the furnishing of one double-acting engine, as above described, was entered into at the same time that the contract for the three single-acting units was consummated, and it is a source of a great deal of satisfaction to us that this double-acting 4-cycle engine, which is now operating in our shops, shows every indication of proving equal in operation to the single-acting engine installed in the Shipping Board's WEST HONAKER, now on her way to Bremen with a load of cotton.

The McIntosh & Seymour single-acting engines were given the usual Shipping Board test, the first one having operated on a continuous run of 30 days under various provisions of the contract. We were no little surprised when the fuel oil which had been delivered for the Shipping Board trial runs was tested on arrival and showed considerable sulphur. It subsequently developed that the average sulphur in this oil over the 30 days period was 2.53 per cent. The Shipping Board figures show a maximum of 3.06 per cent, but our own chemist's tests of samples include a maximum of 4.82 per cent.

This oil was blended at the refinery in a tank holding 15,000 gal. with a temperature at or near zero. It would appear as if the oil never blended thoroughly, but at this low winter temperature came in a stratified condition in the tanks, so that samples taken from different levels in the tank-cars gave entirely different results, although the Shipping Board and ourselves agree on the average sulphur content.

We had not anticipated receiving such a mean fuel oil. Not only did it have high sulphur, but it was also very viscous and we were not prepared with proper heating apparatus to obtain the maximum economies and operating results which would have been obtained from the use of ordinary grades of fuel oil.

Nevertheless, believing that at some time or other the Shipping Board might conceivably be up against the use of such a fuel, we ran our trials on it, more than anything to satisfy the Shipping Board that this character of fuel could be used if it was essential to do so. Published reports show that no oil quite as troublesome as this was used in testing other engines so far built on this Shipping Board Conversion Program, and we are now proud of having passed through such an onerous test, although at the time of the trial we were not so happy about it.

During the long test some conditions arose which could be directly attributed to the use of this grade of oil without proper provision having been previously made for it. The interruption caused on the air compressor unit would have been entirely avoided had we known that we were to be called on to use such oil on the test, especially when the temperature surrounding our fuel tanks was at or near zero. We have since then changed the valve material on these engines to withstand sulphurous fuel.

In the matter of cylinder wear on so large an engine there arose a difference of opinion between the engineers of the Shipping Board and our own engineers. Our engineers maintain that since the smaller bore dimensions are obviously due to the liner settling itself to the individual engine's characteristics of heating and cooling, it is also reasonable to allow that some part of the larger dimensions are traceable to the same cause.

The fact that these liners are in some places larger after heating and cooling should be viewed as a virtue rather than as a fault, because it indicates that the parts are free to expand when heated. In all probability after the first few days' run these dimensions do not materially increase over a long period of operation. We notice similar indications in the official reports on the tests of other engines and believe that a wrong impression of cylinder liner wear may be given to shipowners unless this explanation be added. None of our records show liner wear continued at this rate.

Other conditions which mitigated against obtaining the highest degree of economy were a jacket water inlet temperature of 34 deg. Fahr. and the fact that the independent compressor supplying air for the fuel injection had to be so located in our shops that a pipe measuring 325 ft. long carried the air to the air control valve on the main engine, causing a drop in pressure of approximately 75 lb. per sq. in.

Even under all these adverse conditions the first engine completed its test, meeting all the requirements to the satisfaction of the Technical Division of the Shipping Board, and the second and third engines, tested under more favorable conditions of fuel and water temperature, established records for much higher economy and without operating inconvenience. The official report on the 24 hr. test of the second engine shows a fuel consumption of only 0.402 lb. per b.hp.-hr. including the compressor unit.

Details of the design and construction of the 2700 b.hp. engine of the WEST HONAKER were described and illustrated very fully in the June issue of MOTORSHIP, to which reference should be made for the information. It will be sufficient to summarize here that the engine has 6 cylinders of 32 in. diameter with a stroke of 60 in. and develops its 2700 shaft horsepower at 95 r.p.m.

Like all our engines it has a very firm and rigid bedplate. We hold that rigidity in the bedplate is the starting point of good design. On that we build a rigid frame, and I use the term "rigid" in its literal sense of indeformable. In that way we secure stable conditions of operation for the reciprocating parts and shaft and can rely upon perfect lubrication of all bearings with the consequent reduction of wear to a minimum.

This same practice of rigidity is followed in the cylinder arrangement. We use strong enough sections on the cylinder castings to carry all stresses through the cast iron and we dispense therefore with long bolts from the cylinder heads to the bedplate because they are inherently more elastic.

The cast iron we use for all parts exposed to heat, such as the cylinder covers, liners and piston is of a special nature. We can take a rod of it and make a coiled spring which is so flexible that one end of the coil can be bent around on the other and yet will jump back when the pressure is relieved. Some of the "stunt" pieces we have made from this special iron we use were illustrated on p. 442 of the June number of MOTORSHIP. A study of that picture will help to explain the contentions of our engineers in the matter of cylinder

(*Continued on page* 33)

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Shipping Board's Official Test Report

30 Days' Test on First McIntosh & Seymour 6-Cylinder, 32 in. x 60 in., Single-Acting 4-Cycle Diesel

	Item	Maximum Reading	Minimum Reading	Average Reading
1.....	Load	100 per cent	100 per cent	100 per cent
2.....	Barometer	30.69 in.	29.36 in.	20.96 in.
3.....	Duration	30 days	30 days	30 days
	Pressures			
4.....	Injection air	1006 lb. per sq. in	937 lb. per sq. in	979 lb. per sq. in.
5.....	Jacket cooling water	33.5 lb. per sq. in	22.0 lb. per sq. in	26.2 lb. per sq. in.
6.....	Piston cooling water	33.5 lb. per sq. in	22.0 lb. per sq. in	26.2 lb. per sq. in.
7.....	Lubricating oil	10.8 lb. per sq. in	10.0 lb. per sq. in	10.3 lb. per sq. in.
	Temperatures			
8.....	Atmosphere	42.5 deg. Fahr	11.5 deg. Fahr	29.8 deg. Fahr
9.....	Engine room	77.9 deg. Fahr	63.0 deg. Fahr	69.7 deg. Fahr
10.....	Fuel oil	148.2 deg. Fahr	125.4 deg. Fahr	139.2 deg. Fahr
11.....	Cooling water inlet	35.0 deg. Fahr	35.0 deg. Fahr	35.0 deg. Fahr
12.....	Cooling water outlet	114.0 deg. Fahr	113.8 deg. Fahr	113.9 deg. Fahr
13.....	Exhaust	738.0 deg. Fahr	688.9 deg. Fahr	718.5 deg. Fahr
	Fuel Analysis			
14.....	High heat value	18,926 B.t.u.	18,650 B.t.u.	18,780 B.t.u.
15.....	Low heat value	17,829 B.t.u.	17,633 B.t.u.	17,706 B.t.u.
16.....	Beaumé gravity	23.3 deg.	19.9 deg.	21.1 deg.
17.....	Saybolt Furol (at 77 deg. Fahr.)	65 sec.	26 sec.	50.8 sec.
18.....	Sulphur content	3.06 per cent	1.83 per cent	2.53 per cent
19.....	Flash (Pensky-Martens)	220 deg. Fahr	174 deg. Fahr	197 deg. Fahr
20.....	Burning point	247 deg. Fahr	203 deg. Fahr	225 deg. Fahr
21.....	Lb. per hr.	1293 lb.	1198 lb.	1256 lb.
22.....	Lb. per i.hp.-hr.	0.34 lb.	0.32 lb.	0.33 lb.
23.....	Lb. per bhp.-hr.*	0.44 lb.	0.42 lb.	0.43 lb.
	Power and Efficiency			
24.....	Engine speed	95.7 r.p.m.	95.1 r.p.m.	95.4 r.p.m.
25.....	I.hp. power cylinders	3502 i.hp.	3210 i.hp.	3334 i.hp.
26.....	M.i.p	99.3 lb. per sq. in	91.6 lb. per sq. in	95.6 lb. per sq. in.
27.....	M.e.p. (calculated)	78.6 lb. per sq. in	76.8 lb. per sq. in	77.7 lb. per sq. in.
28.....	Brake horsepower	2721 b.hp.	2704 b.hp.	2712 b.hp.
29.....	Mechanical efficiency	83.5 per cent	77.4 per cent	81.4 per cent
30.....	Thermal efficiency	33.3 per cent	31.3 per cent	32.1 per cent

*Corrected to 18,500 B.t.u. and includes independent compressor unit plus b.hp. carried on that unit.

30 Days' Test on McIntosh & Seymour 4-Cylinder, 17 in. x 24 in., Independent Compressor Unit

	Item	Maximum Reading	Minimum Reading	Average Reading
1.....	Load	100 per cent	100 per cent	100 per cent
2.....	Duration	30 days	30 days	30 days
3.....	Injection air	1078 lb. per sq. in	1021 lb. per sq. in	1059 lb. per sq. in.
4.....	Lubricating oil	13 lb. per sq. in	10 lb. per sq. in	11 lb. per sq. in.
5.....	Exhaust temperature	705 deg. Fahr	502 deg. Fahr	659 deg. Fahr
6.....	Engine speed	200 r.p.m.	189 r.p.m.	190 r.p.m.
7.....	I.hp. power cylinders	565 i.hp.	464 i.hp.	526 i.hp.
8.....	M.i.p.	108 lb. per sq. in	88 lb. per sq. in	100 lb. per sq. in.
9.....	I.hp. of air compressors	344 i.hp.	281 i.hp.	303 i.hp.
10.....	Extra b.hp. load	109 b.hp.	19 b.hp.	100 b.hp.

Shop Tests on Second McIntosh & Seymour 6-Cylinder, 32 in. x 60 in., Single-Acting 4-Cycle Diesel

	Item	Maximum Reading	Minimum Reading	Average Reading
1.....	Load	100 per cent	115 per cent	100 per cent
2.....	Barometer	——	——	——
3.....	Duration of test	24 hr.	5 hr.	1 hr.
	Pressures			
4.....	Injection air	1001 lb. per sq. in	1010 lb. per sq. in	1000 lb. per sq. in.
5.....	Jacket cooling water	35.8 lb. per sq. in	30.2 lb. per sq. in	37.0 lb. per sq. in.
6.....	Piston cooling water	35.8 lb. per sq. in	30.2 lb. per sq. in	37.0 lb. per sq. in.
7.....	Lubricating oil	10.0 lb. per sq. in	10.0 lb. per sq. in	10.0 lb. per sq. in.
	Temperatures			
8.....	Atmosphere	57.1 deg. Fahr	65.0 deg. Fahr	60.0 deg. Fahr
9.....	Engine room	71.4 deg. Fahr	72.0 deg. Fahr	70.0 deg. Fard
10.....	Fuel oil	133.2 deg. Fahr	134.0 deg. Fahr	134.0 deg. Fahr
11.....	Cooling water inlet	38.0 deg. Fahr	38.0 deg. Fahr	38.0 deg. Fahr
12.....	Cooling water outlet	106.8 deg. Fahr	113.9 deg. Fahr	111.8 deg. Fahr
13.....	Exhaust	760.8 deg. Fahr	856.6 deg. Fahr	791.6 deg. Fahr
	Fuel Analysis			
14.....	High heat value	18,997 B.t.u.	18,997 B.t.u.	18,997 B.t.u.
15.....	Low heat value	17,900 B.t.u.	17,900 B.t.u.	17,900 B.t.u.
16.....	Beaumé gravity	—— deg.	—— deg.	—— deg.
17.....	Saybolt Furol (at 77 deg. Fahr.)	—— sec.	—— sec.	—— sec.
18.....	Sulphur content	—— per cent	—— per cent	—— per cent
19.....	Flash (Pensky-Martens)	—— deg. Fahr	—— deg. Fahr	—— deg. Fahr
20.....	Burning point	—— deg. Fahr	—— deg. Fahr	—— deg. Fahr

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Shipping Board's Official Test Report

(*Continued from previous page*)

	Fuel Consumption			
21.....	Lb. per hr.	1176 lb.	1374 lb.	1228 lb.
22.....	Lb. per i.hp.-hr.	0.304 lb.	0.316 lb.	——
23.....	Lb. per b.hp.-hr.*	0.402 lb.	0.423 lb.	0.415 lb.
	Power and Efficiency			
24.....	Engine speed	95.5 r.p.m.	99.4 r.p.m.	97.0 r.p.m.
25.....	I.hp. power cylinders	3346 i.hp.	3827 i.hp.	3536 i.hp.
26.....	M.i.p.	95.6 lb. per sq. in.	104.4 lb. per sq. in.	99.7 lb. per sq. in.
27.....	M.e.p. (calculated)	77.6 lb. per sq. in.	84.2 lb. per sq. in.	77.7 lb. per sq. in.
28.....	BRAKE HORSEPOWER	2715 b.hp.	3086 b.hp.	2757 b.hp.
29.....	Mechanical efficiency	81.1 per cent	80.6 per cent	78.0 per cent.
30.....	Thermal efficiency	34.2 per cent	32.5 per cent	33.2 per cent.

*Corrected to 18,500 B.t.u., and includes independent compressor unit plus b.hp. carried on that unit.

Varying Load Tests on First McIntosh & Seymour 6-Cylinder, 32 in. x 60 in., Single-Acting 4-Cycle Diesel

	ITEM	Overload Test READING	5 Per Cent Overspeed READING	¾ Load Test READING
1.....	Load	110 per cent	110 per cent	75 per cent
2.....	Barometer	——	——	——
3.....	Duration of test	6 hr.	4 hr.	6 hr.
	Pressures			
4.....	Injection air	1015 lb. per sq. in.	1000 lb. per sq. in.	953 lb. per sq. in.
5.....	Jacket cooling water	42.2 lb. per sq. in.	45.3 lb. per sq. in.	60.0 lb. per sq. in.
6.....	Piston cooling water	42.2 lb. per sq. in.	45.3 lb. per sq. in.	60.0 lb. per sq. in.
7.....	Lubricating oil	10.0 lb. per sq. in.	11.0 lb. per sq. in.	10.5 lb. per sq. in.
	Temperatures			
8.....	Atmosphere	33.7 deg. Fahr.	30.5 deg. Fahr.	23.3 deg. Fahr.
9.....	Engine room	66.0 deg. Fahr.	66.0 deg. Fahr.	69.7 deg. Fahr.
10.....	Fuel oil	140.2 deg. Fahr.	143.3 deg. Fahr.	141.2 deg. Fahr.
11.....	Cooling water inlet	35.0 deg. Fahr.	35.0 deg. Fahr.	35.0 deg. Fahr.
12.....	Cooling water outlet	116.1 deg. Fahr.	115.4 deg. Fahr.	112.4 deg. Fahr.
13.....	Exhaust	796.6 deg. Fahr.	808.3 deg. Fahr.	572.5 deg. Fahr.
	Fuel Analysis			
14.....	High heat value	18,780 B.t.u.	18,780 B.t.u.	18,789 B.t.u.
15.....	Low heat value	17,706 B.t.u.	17,706 B.t.u.	17,706 B.t.u.
	Fuel Consumption			
16.....	Lb. per hr.	1389 lb.	1455 lb.	952 lb.
17.....	Lb. per i.hp.-hr.	0.363 lb.	0.364 lb.	0.339 lb.
18.....	Lb. per b.hp.-hr.*	0.431 lb.	0.436 lb.	0.427 lb.
	Power and Efficiency			
19.....	Engine speed	95.4 r.p.m.	100 r.p.m.	86.2 r.p.m.
20.....	I.hp. power cylinders	3664 i.hp.	3831 i.hp.	2686 i.hp.
21.....	M.i.p.	105.4 lb. per sq. in.	104.8 lb. per sq. in.	83.7 lb. per sq. in.
22.....	M.e.p. (calculated)	85.7 lb. per sq. in.	84.5 lb. per sq. in.	63.1 lb. per sq. in.
23.....	BRAKE HORSEPOWER	2981 b.hp.	3087 b.hp.	2025 b.hp.
24.....	Mechanical efficiency	81.4 per cent	80.6 per cent	75.4 per cent.
25.....	Thermal efficiency	31.9 per cent	31.6 per cent	32.2 per cent.

*Corrected to 18,500 B.t.u., and includes independent compressor unit plus b.hp. carried on that unit.

Varying Load Tests on First McIntosh & Seymour 6-Cylinder, 32 in., x 60 in., Single-Acting 4-Cycle Diesel

	ITEM	Half Load Test READING	Quarter Load Test READING	No Load Astern READING
1.....	Load	50 per cent	25 per cent	nil
2.....	Barometer	——	——	——
3.....	Duration of test	4 hr.	2 hr.	1 hr.
	Pressures			
4.....	Injection air	879.0 lb. per sq. in.	810.0 lb. per sq. in.	975.0 lb. per sq. in.
5.....	Jacket cooling water	60.0 lb. per sq. in.	60.0 lb. per sq. in.	25.0 lb. per sq. in.
6.....	Piston cooling water	60.0 lb. per sq. in.	60.0 lb. per sq. in.	25.0 lb. per sq. in.
7.....	Lubricating oil	10.0 lb. per sq. in.	10.0 lb. per sq. in.	11.0 lb. per sq. in.
	Temperatures			
8.....	Atmosphere	31.0 deg. Fahr.	34.0 deg. Fahr.	32.0 deg. Fahr.
9.....	Engine room	60.0 deg. Fahr.	70.0 deg. Fahr.	72.0 deg. Fahr.
10.....	Fuel oil	148.3 deg. Fahr.	153.0 deg. Fahr.	130.0 deg. Fahr.
11.....	Cooling water inlet	35.0 deg. Fahr.	35.0 deg. Fahr.	35.0 deg. Fahr.
12.....	Cooling water outlet	111.0 deg. Fahr.	122.6 deg. Fahr.	82.6 deg. Fahr.
13.....	Exhaust	455.4 deg. Fahr.	312.5 deg. Fahr.	—— deg. Fahr.
	Fuel Analysis			
14.....	High heat value	18,780 B.t.u.	18,780 B.t.u.	18,780 B.t.u.
15.....	Low heat value	17,706 B.t.u.	17,706 B.t.u.	17,706 B.t.u.
	Fuel Consumption			
16.....	Lb. per hr.	707.3 lb.	488.0 lb.	415.0 lb.
17.....	Lb. per i.hp.-hr.	0.367 lb.	0.427 lb.	——
18.....	Lb. per b.hp.-hr.*	0.465 lb.	0.593 lb.	0.541 lb.
	Power and Efficiency			
19.....	Engine speed	75.0 r.p.m.	60.4 r.p.m.	95.4 r.p.m.
20.....	I.hp. power cylinders	1844 i.hp.	1093 i.hp.	735 i.hp.
21.....	M.i.p.	68.8 lb. per sq. in.	49.2 lb. per sq. in.	21.0 lb. per sq. in.
22.....	M.e.p. (calculated)	50.3 lb. per sq. in.	30.6 lb. per sq. in.	——
23.....	BRAKE HORSEPOWER	1347 b.hp.	679 b.hp.	——
24.....	Mechanical efficiency	73.0 per cent	62.2 per cent	——

*Corrected to 18,500 B.t.u., and includes independent compressor unit plus b.hp. carried on that unit.

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Shipping Board's Official Test Report

Brands Used and Consumption of Lub. Oils on West Honaker's engines

ENGINE PART	BRAND	DROPS PER MIN.	GAL. PER DAY
Cylinders, main engine	Tursel Ex. Hy	65 per cyl.	2.45
	Socony Grade B	65 per cyl.	2.45
	Socony Ex. Hy	65 per cyl.	2.45
Cylinders, comp. engine	Tursel Ex. Hy	8 per cyl.	1.62
	Socony Grade B	8 per cyl.	1.62
Cylinders, compressor	Tursel Ex. Hy	36 all cyl.	1.13
	Heavy X	36 all cyl.	1.13
Forced feed	Tursel Ex. Hy	——	6.64
Hand feed	Tursel Ex. Hy	——	1.21

Total oil consumed per 24 hr. for all purposes, 13.05 gal.

Number of Days Each Brand of Oil Was Used

Main Eng. Days	Comp. Eng. Days	Brand	Main Eng. Cyls.	Comp. Eng. Cyls.	Air Comp.
14	12	Tursel Ex. Hy	*	*	*
3	13	Socony Grade B	*	*	—
13	—	Socony Ex. Hy	*	—	—
—	2	Heavy Ex	—	—	*

Tursel Ex. Heavy used throughout test for forced feed.

See also footnote to "Brands Used and Consumption of Lub. Oils."

Condition of Main Engine

All main engine parts were examined after the test and found generally in very good condition, except exhaust valve stems and piston rings. Some of the rings were found stuck in grooves and required freeing.

Compressor Engine Stops

Main engine was not shut down during entire 30 days' test, but operated without load during repairs on compressor unit, injection air being supplied by two auxiliary engines. Time main engine operated without load was made up at end, giving 30 days' running time on load.

Total time main engine without load, 5 hr. 48 min. Total time compressor unit stopped 5 hr. 22 min.

First stop was to renew 2 leaky exhaust valves on compressor engine.

Second stop was to replace 2 third-stage compressor discharge valves which had become plugged.

Third stop was to renew the piston rings in third stage of compressors. The excessive wear on compressor parts is attributed to dirty air from shop in which tests were run.

Cast-iron exhaust valve discs were used on compressor engine at start, but were changed to nichrome during first stop period (see Chemical Analyses of Deposits Taken from Various Places on Main Engine and Air Compressor).

Details of Compressor Engine Stops

DAY OF TEST	REASON FOR STOP	COMP. UNIT STOPPED	NO LOAD MAIN ENGINE
13th	2 exhaust valves renewed	0 hr. 32 min.	0 hr. 44 min.
26th	2 third-stage comp. valves	1 hr. 44 min.	1 hr. 57 min.
29th	compressor piston rings	3 hr. 6 min.	3 hr. 7 min.

Erosion of exhaust valve stems is attributed to high sulphur content of fuel in combination with sweat from cooling water passing through stems (see "Chemical Analyses of Deposits Taken from Various Places on Main Engine and Air Compressors").

Wear on Third Stage Compressor Liners

COMPRESSOR	MAXIMUM	MINIMUM	AVERAGE
No. 1	0.025 in.	0.021 in.	0.023 in.
No. 2	0.025 in.	0.017 in.	0.020 in.
No. 3	0.032 in.	0.018 in.	0.025 in.

Four radial measurements were taken at upper point of piston ring travel and at center of cylinder. The average wear represents the mean of the eight measurements.

All first- and second-stage liners were in excellent condition showing no wear. The three third-stage liners were renewed after the test, due to dirty air from the shop.

All other parts of air compressors and engine were examined after the test and found in excellent condition.

Wear on Cylinder Liners—Main Engine

	NO. 1	NO. 2	NO. 3	NO. 4	NO. 5	NO. 6
Maximum	0.0115 in.	0.008 in.	0.0045 in.	0.0125 in.	0.0025 in.	0.00925 in.
Minimum	0.01125 in.	0.006 in.	0.0015 in.	0.0000 in.	0.001 in.	0.002 in.
Average	0.0115 in.	0.007 in.	0.0025 in.	0.0115 in.	0.0015 in.	0.0055 in.

Main engine liner wear represents the mean of six measurements. Two radial measurements were taken at three equally divided points of piston ring travel.

"Growth" in Cylinder Liners—Main Engine

	NO. 1	NO. 2	NO. 3	NO. 4	NO. 5	NO. 6
Maximum	0.00525 in.	0.00425 in.	0.009 in.	0.007 in.	0.0025 in	0.00925 in.
Minimum	0.0025 in.	0.001 in.	0.0025 in.	0.0005 in.	0.001 in.	0.002 in.
Average	0.004 in.	0.002 in.	0.0055 in.	0.004 in.	0.0015 in.	0.0055 in.

See footnote to "Wear on Cylinder Liners—Main Engine."

Wear on Cylinder Liners—Compressor Unit

	NO. 1	NO. 2	NO. 3	NO. 4
Maximum	0.005 in.	0.00575 in.	0.0025 in.	0.0015 in.
Minimum	0.0045 in.	0.005 in.	0.000 in.	0.0015 in.
Average	0.0045 in.	0.0055 in.	0.001 in.	0.0015 in.

Compressor unit average liner wear represents the mean of six measurements. Two radial measurements were taken at three equally divided points of piston ring travel.

Editorial Notes Relative to Official Report of Engine Tests

Engine Stops

There was no stop on the main engine during the 30 days' trial, but the independent compressor set was shut down three times to correct troubles incidental to the test and to the stop that would not likely occur at sea.

From the bald statement of facts in the official Shipping Board report of the trials it is clear that: 1) the fuel had a considerable sulphur content and 2) the compressor was using dirty air. The stops of the independent compressor set were directly attributable to these two conditions, the latter of which would never be encountered at sea and the former of which has now been provided against.

When the first stop was made on account of two leaky exhaust valves the opportunity was taken to change the exhaust valves from the cast-iron disc type to the nichrome type to resist the sulphurous corrosion.

The second and third stops were caused by the dirty air taken into the compressor. It must be kept in mind that when air is compressed from atmosphere to 1000 lb. per sq. in. the relative quantity of entrained dirt would be 65 times greater in the dense compressed air than in the free air if none of the dirt were thrown down in the interstage coolers. This will help to an understanding of the official reference to the replacement of two-third stage discharge valves "which have become plugged." On the 26th day a stop was made to renew the piston rings in the third stage of the compressors, and when the 30 days' trial had been completed the liners of the third stage of the compressors were renewed, the dirty air having caused excessive wear.

That sort of trouble will not be encountered at sea.

Fuel Consumption

An average of 0.402 lb. per b.hp.-hr. was recorded in the 24 hours' trial of the second engine, which made its test under more favorable conditions than the first engine.

All fuel consumption figures comprise the fuel used by the independent compressor set, on which the main engine depends for injection air, and the figures are reduced to the standard of 18,500 B.t.u. per lb. of fuel.

Measurements of Wear

Reference should be made to the remarks on this subject in A. E. Ballin's article, "Development of West Honaker's Engine."

Chemical Analyses of Deposits Taken from Various Places on Main Engine and Air Compressor

SAMPLE NO.	TAKEN FROM	MOISTURE	OILY MATTER SOLUBLE	CARBON SOLID	IRON OXIDES	COPPER OXIDE	ZINC OXIDE	MANGANESE OXIDE	SILICA	SODIUM OXIDE	SULPHURIC ANHYDRIDE	COMBINED WATER
1.	Comp. discharge valves, h.-p. stage	1%	——	17%	16%	29%	trace	trace	——	trace	21%	16%
2.	Exhaust valve stem cage guide	1%	——	——	30%	3%	1%	trace	2%	trace	13%	48%
3.	Exhaust valve disc	——	——	——	14%	trace	——	——	——	much	36%	——
4.	No. 5 piston crown	2%	20%	30%	20%	——	——	——	——	——	28%	——

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Electric Installation on West Honaker

Extent of the Electrification of This Ship Is Demonstrated by the Following Review of Electric Connections and Fixtures

By E. C. Alger*

IN converting this ship the U. S. Shipping Board required that all the old wiring and the conduit be removed. All the new wiring now on the ship is a straight leaded and armored Navy type cable job throughout. All the cables, the electrical apparatus, motors, switchboards, etc., except light fixtures, were supplied by the U. S. Shipping Board.

This installation is now a power plant consisting of three 75 kw. 240 volt d.c. Ridgway Dynamo & Electric Mfg. Co.'s generators. One of the 75 kw. generators is direct-connected to a 4-cylinder 4-cycle air-injection McIntosh & Seymour engine of 400 b.hp. while the other two are connected with 2-cylinder 4-cycle air-injection McIntosh & Seymour engines of 108 b.hp. each. The 400 b.hp. engine set has three 3-stage air compressors mounted on the same bedplate with the generator. The 14 kw. generator is connected to a 22 b.hp. Diesel engine, and there is also an auxiliary air compressor mounted on the same bedplate.

The switch and control board is located in the forward part of the engine room and provides for parallel operation of the generators. There have been a number of features incorporated in this switchboard which are not common to this class of ship, the most outstanding being that the control panel for all of the engine room motor-driven auxiliaries forms the base of the switchboard—this puts the control panel under the eye of the switchboard operator and leaves only the stop and start pushbuttons at the auxiliaries. In some cases a field rheostat has been mounted near the pushbutton so that the speed of the auxiliary can be varied from time to time. Another outstanding feature is that the switchboard is furnished with watt-hour meters with the necessary switches for obtaining the power consumption of the different groups of auxiliaries, such as deck auxiliaries forward, deck auxiliaries aft, steering gear, and engine room auxiliaries.

The searchlight is a Sperry 18 in. incandescent type, with a 1000 watt tubular projector light.

The ship's lighting consists of approximately 270 of the standard watertight fixtures of the F. H. Lovell Co.'s type, and decorative fixtures of the Dayton Mfg. Co.'s and Chas. Cory Co.'s types usually found on this class of ship, as well as ten 5-light cargo cluster reflectors and forty-six 10 in. oscillating and non-oscillating fans of the Diehl type. Two 200-watt units are mounted on each mast for general illumination while loading and unloading.

The electric equipment for the winches, windlasses and steering gear is of the Westinghouse type, with cam controllers in addition to contactor panels, while the engine room auxiliaries are operated by General Electric Co. motors and Cutler-Hammer controls. The controllers for the winches are mechanically operated from the top of the winch house and are so arranged that one operator can handle two winches at a time.

The switchboard also supplies power to the following equipment:

18 in. searchlight,
Ship's lighting,
Winches,
Steering gear,
Windlass,
Refrigerating machine,
Turning gear for main engines,
Lubricating oil purifier,
Fuel oil purifiers,
Fresh water pumps,
Salt water cooling and general service pumps,
Fire and bilge pumps,
Engine room bilge pumps,
Sanitary pumps,
Lubricating oil pumps,
Fuel oil transfer pumps,
Electric water heaters,
Gyro compass,
Radio.

The electric steering gear is of the Sperry automatic dual electric type with the gyro-pilot located in the pilot house. The gyro compass is of the Sperry type and consists of a master compass located in a compartment below with its independent motor-generator. The master compass supplies energy to two repeaters, as well as to the steering gear control.

The electric water heaters of 15 gal. and 200 gal. capacity, as manufactured by the Automatic Electric Heater Co. and fitted with Sepco thermostatic control graduated to maintain a temperature of 160 deg. Fahr., supply the hot water service. To save running a steam line to the carpenter's shop forward, a 1000-watt electric Niagara steam radiator has been provided with Sepco thermostatic control.

The radio consists of a 1 kw. spark set and a 2 kw. arc set, furnished by the U. S. Shipping Board.

Provision has been made for supplying the ship with power while in port through a 600-amp. shore connection switch.

The regular call bells, with annunciators, general alarm gongs, voice tubes and mechanical telegraphs have been provided, as well as a telephone system especially designed for this ship by Chas. J. Henschell, Inc.

The speed of the main engine is indicated by means of a Sperry electric tachometer system, with indicators in the engine room and pilot house.

The exhaust temperatures of the main engine are indicated by means of a pyrometer, with a thermocouple in each of the exhaust pipes, and an indicator with a selective switch located near the platform in the engine room.

A system of electric alarms has been provided to indicate the level of oil in the raw fuel oil and daily supply tanks, as well as an electric alarm system for giving a warning to the operator when the pressure of the circulating water or lubricating oil for the main engine drops below a predetermined point.

After reading this description of the electrical installation one can imagine the magnitude of the installation when it is considered that installation had to be planned by the installing department before the new structural work was in place, and the manner in which the installation has been made certainly has been a credit to the Bethlehem Shipbuilding Corporation.

*Chief Electrical Draftsman, Fore River Plant, Bethlehem Shipbuilding Corporation, Ltd.

Development of West Honaker's Engine

(*Continued from page* 29)

liner measurements referred to just above.

We are proud of this engine as we are of all our engines, and the record I have given above of our ship installations shows that we have reason to feel pride. The unusual opportunity which MOTORSHIP has given me to deal with our WEST HONAKER engine seems to have called very fittingly for a review of the marine work we have carried out. It will serve to remind many shipowners that motorships are not new even in this country and that indeed there is quite a history to them—a history of success.

That the Shipping Board is now demonstrating to American owners that we have an industry in this country capable of taking care of their largest needs is most commendable and a great service to the nation. This demonstration will be of great aid in advancing the modernization of the great fleet of vessels that carry our huge waterborne commerce on the ocean, and coastwise, and on rivers and lakes. With such modernization will come greater economy and efficiency in the transportation of all our waterborne freight.

A batch of six of the fleet of 33 Coast Guard patrol vessels now building at the Camden Yard of the American Brown Boveri Electric Corporation, was launched at the end of November. One hour was occupied for the total launching of the six ships. They are a development of the first Diesel patrol boats and have a length overall of 125 ft.; a beam molded on waterline of 23 ft. 6 in.; a depth molded of 12 ft., and a displacement of about 220 tons. Each ship is propelled by two 6-cylinder 150 b.hp. Winton Diesels. The fuel-oil tank under service conditions has a net capacity of 6650 gal.

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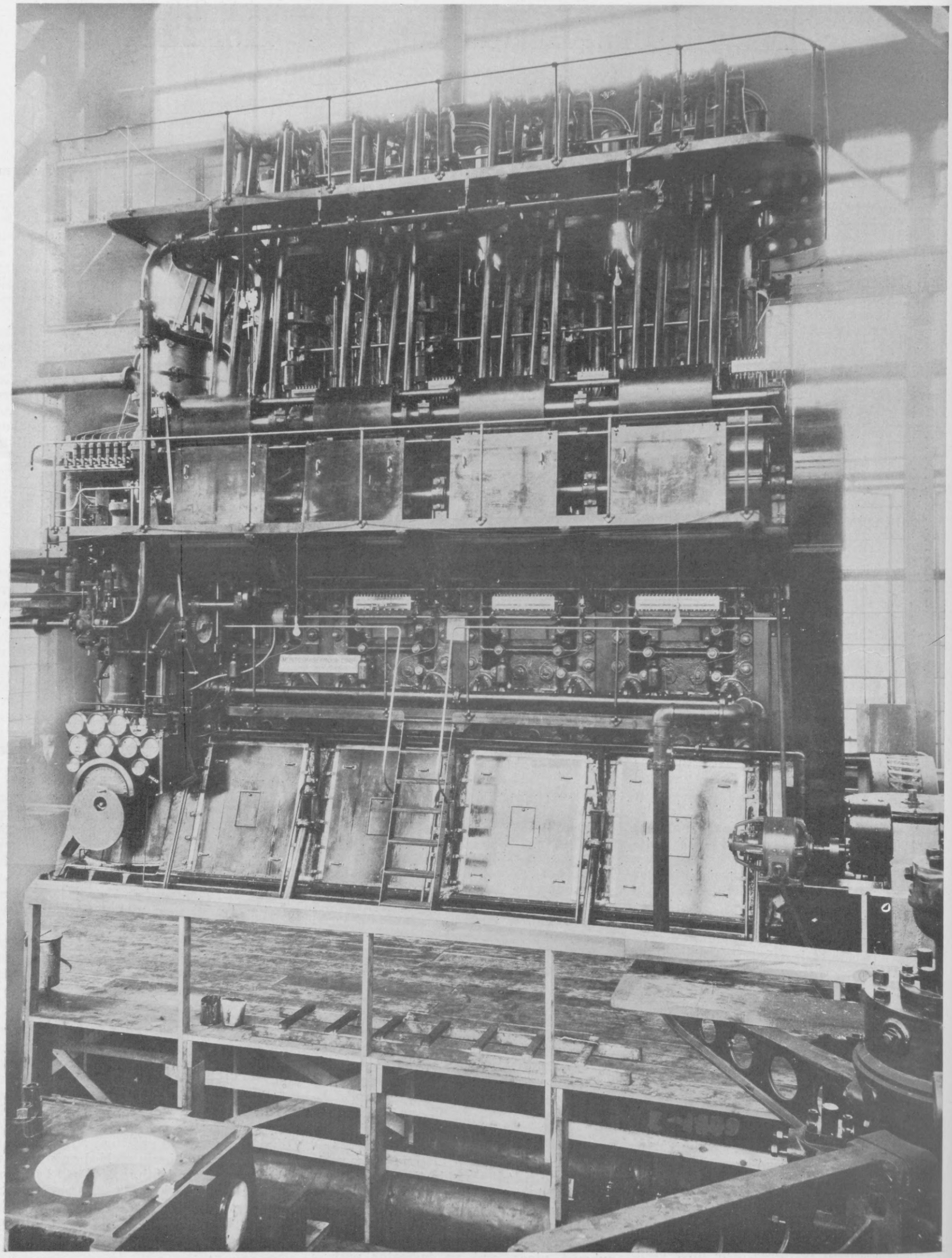

McIntosh & Seymour double-acting 4-cycle engine for the U. S. Shipping Board developing 2700 s.hp. from 4 cylinders at 95 r.p.m.

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McIntosh & Seymour Double-Acting Engine

Remarkable Accomplishment of American Firm in Producing a Double-Acting Engine in Total Period of Two Years

ONE thousand horsepower per crank is the capacity of the double-acting engine that McIntosh & Seymour have added to their line of engines. That is the power for which the engine has been designed: 4000 b.hp. in 4 cylinders, 6000 b.hp. in 6 cylinders, 8000 b.hp. in 8 cylinders. The reasons for this choice of power show very clearly the policy of the firm and the underlying attitude of the firm towards Diesel engine development.

Steadfast adherents of the 4-cycle system of operation, the McIntosh & Seymour Corporation gradually advanced the maximum power of its engine program from 500 hp. in 1915 until in 1926 it attained a figure of 3600 hp., representing an 8-cylinder engine of the type it has built with 6 cylinders for the WEST HONAKER, WEST CUSSETA, and CROWN CITY of the Shipping Board. This 8-cylinder engine could be speeded up in a twin-screw installation to develop 4500 b.hp.

Possibility of 32,000 b. hp.

At that power the firm reaches the cylinder diameter of 32 in. which is generally accepted as the desirable limit of 4-cycle design under present-day conditions, and right there it stepped over from the single-acting system to the double-acting system, practically doubling the maximum engine power of its program.

This presents the possibility of 32,000 b.hp. in a quadruple screw ship, or by accepting more than 8 cylinders per engine—and there is a tendency in that direction both here and abroad—even higher powers could be installed in such a vessel. McIntosh & Seymour have thus taken care of the possible marine development of the next few years ahead.

A most inspiring clearness of thought has characterised the entire conception and accomplishment of the latest enterprise in Auburn. The goal was set, analysis made of the conditions and circumstances to be met, all the issues considered and the design then drawn with such sureness and completeness that the first engine could be erected and prepared for the searching 30 days' trial of the Shipping Board with the same regularity and finality that marked the completion of the single-acting engine for the Government. Where else in the world has that accomplishment been equalled? No experimental unit was built; there was no rehashing of the design as the engine parts went through the shops, no tearing down of the first erection. Can any fair-minded man deny that this represents a very remarkable achievement?

Let us take some measure of its significance. An American firm has accomplished in one operation as much as any European firm has done in several operations, and there are some very fine firms in Europe. The goal has always been considered a difficult one to reach, and there is unusual merit in reaching it swiftly and directly. Of at least equal significance is the proof McIntosh & Seymour have furnished that the design of the double-acting Diesel engine *per se* is tractable and manageable by competent engineers with clear minds and that such discussion as there has been, and still is, about complications of its design has arisen from failure to think the subject through clearly to the end.

It may be contended that this double-acting engine has not proved itself, and that at least a year at sea must pass before the proof can be considered conclusive. That is a safe argument, but it is the argument of a trailer, not of a leader. Had the Shipping Board been governed by it, this engine would not have been built just yet. Had the East Asiatic Company years ago bowed to a similar argument the SELANDIA would never have been built. Had Dan Broström been influenced by it the GRIPSHOLM would not have been operating. All development is undertaken and guided by those who pit their judgment of the unproved factors against the conservatism of the world.

A Successful Accomplishment

There are in this McIntosh & Seymour development certain factors that make so strongly for success that there seems no reason for hesitancy about treating the engine as a successful accomplishment. There may be little things about it that will be changed. Such changes are made in every new machine tool, automobile model or other piece of newly developed machinery when it first comes out. The main features, however, have been settled along clearly thought-out lines, and will not be found deficient.

A detailed description of the engine cannot be given at this date, because the patents on the lower cylinder end have yet to be worked out and therefore at present it is desirable to withhold those details from publication. Only the broad outlines of the engine design can therefore be properly given here.

The engine has four double-acting cylinders of 32 in. diameter. With a piston stroke of 52 in. and turning at 95 r.p.m., the engine develops 2700 b.hp. driving its own compressor. For economy in production the 32 in. cylinder was selected because that is the cylinder diameter of the big single-acting engine, and many parts such as the upper cylinder heads, upper valve gear, etc., can be duplicated in the two styles of engines. Normally this type would be built with 60 in. stroke, but in order to reduce the power to contract the stroke was cut to 52 in. In bigger engines of the same type the number of cylinders can be increased to six or eight, or even to nine and to ten, and the compressor need not necessarily be direct-connected with the engine,—there is indeed a trend towards the independently operated compressor in multi-engine installations of large power.

Bedplate, framing, crankshaft, upper cylinder covers and valve gear, fuel pumps, control, etc., follow the lines of McIntosh & Seymour single-acting practice. The new design is in the lower cylinder covers and valve gear, pistons, piston rods and cylinder liners. These will be described in the future when the patent situation is clear. At present the observation must suffice that the design of the lower cylinder ends conforms much more closely to normal Diesel practice than the lower ends of other double-acting engines have done.

Contrasting this double-acting engine of 2700 b.hp. with the single-acting engine of the same power built by the same firm for the Shipping Board, there are two important qualifications to be kept in view. The d.-a. engine drives its own compressor; the s.-a. engine does not. The d.-a. engine has a stroke of only 52 in.; the s.-a. engine has a stroke of 60 in. The contrast cannot therefore be made on a uniform basis.

Saving in Engine Length

There is a saving in engine length in favor of the double-acting engine, and of course no extra space required in the engine room for a big compressor set. There is a saving in engine weight in favor of the double-acting engine when account is taken of the compressors. There is a saving in engine price in favor of the double-acting engine, and the saving of cost extends into the foundation for the engine in the ship, the erection of the engine in the ship and the absence of the independent compressor set.

All the advantage lies with the double-acting engine on such a comparison, but note that the comparison is really only an academic one, for the double-acting engine begins where the single-acting engine leaves off. The two types are brought to a near basis only by the qualifications specified above.

The really clear way to summarize the McIntosh & Seymour development is to regard the difference between the two types as also largely academic, and contemplate the engine program as including a series of power from 200 hp. to 8000 hp. per engine. What does it matter in the analysis of the service performed by the ship whether the engine is of the single-acting or double-acting type, provided the engine is the best adapted for the particular conditions to be fulfilled? Up to a certain point the single-acting engine will be used; beyond that point the double-acting engine will be taken. If the two types are equally dependable and economical, the engine program is complete, and that seems to be the case here.

Practically all tank ships now on the stocks are Diesel propelled, says a bulletin issued by the American Research Foundation. The world's fleet of tankers of 500 tons and over numbers 961 ships and of these 391 are U. S. flag ships—the largest number owned by any single nation.

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UNITED STATES SHIPPING BOARD
WASHINGTON

November 29, 1926.

My dear Mr. Crowly:

The twelve copies of the December issue of "Motorship" which you refer to in your letter of the 26th, have been received, and I thank you very much for sending them to me. I am distributing these to certain persons where I think they will really do the most good.

The article is splendidly illustrated, and the detailed description is most excellent. It is particularly gratifying to note there are practically no points omitted that would be of interest either to a technical man or business man who contemplated doing likewise with their ships. I congratulate you on the very excellent way in which the subject is treated, and thank you, of course, for sending me the extra copies.

Very sincerely yours,

W. S. Benson

Commissioner.

Mr. R. W. Crowly,
"Motorship"
220 West 42nd St.,
New York, N. Y.

"No points omitted that would be of interest either to a technical man or business man," writes Admiral W. S. Benson relative to the articles on the Shipping Board's converted motorship Tampa in the December issue of this magazine. The West Honaker is similarly treated in this number of MOTORSHIP *and other articles of equal value are being prepared.*

UNITED STATES SHIPPING BOARD
WASHINGTON

December 18, 1926

Dear Mr. Crowly:

Admiral Benson requests me to say to you, in response to your letter of yesterday's date, that he would be very glad to have you publish his letter to you of November 29th.

Sincerely yours,

Dan Eldridge

DAN ELDRIDGE
(Secretary to Admiral W.S.Benson

Mr. R. W. Crowly,
Editorial Adviser, "Motorship"
220 West 42nd St.,
New York, N. Y.

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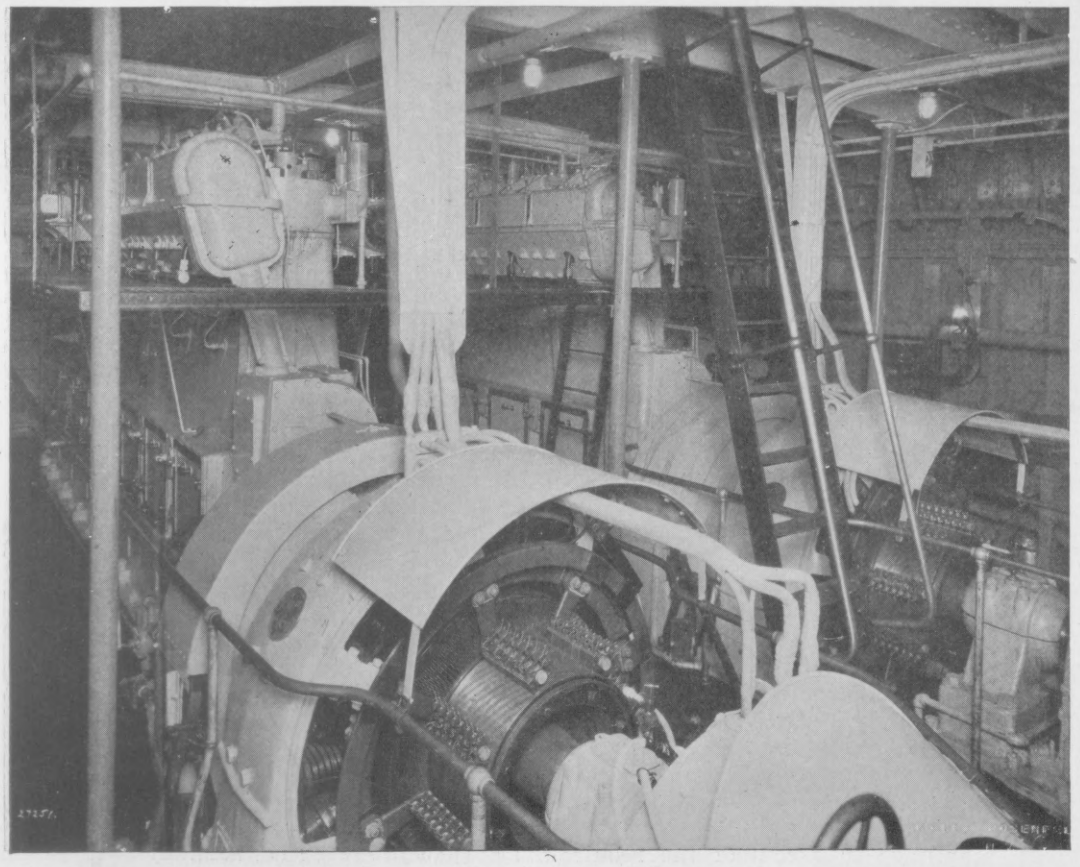
New York Central's Big Diesel Towboat

With Two 400 hp. Engines Driving Generators It Is One of the Most Powerful Diesel-electric Towboats in Service

TWO 6-cylinder, 4-cycle Diesels of McIntosh & Seymour type, rated at 400 b.hp. each and each coupled to a 270 kw. General Electric generator form the main generating plant for New York Central's first Diesel-electric towboat, which is incidentally one of the most powerful Diesel-electric towboats in the world. She will shortly be followed by a sister vessel.

The propelling motor is a shunt-wound, double-armature unit, and when connected in series with the two main generators, delivers 650 s.hp. to the shaft.

The new vessel, which has been constructed by the Staten Island Sb. Co., was delivered to her owners about the middle of December and since that date has been actively engaged in heavy towing work around New York harbor. She is a well-modelled vessel of all steel construction, with a deck house extending over two-thirds of the length of the main deck. This house is rounded at the aft end and not cut square as is usual in many towboats, the object being to prevent or to minimize wear due to chafing of tow ropes with barges or car floats towing alongside.



Two 6-cylinder 4 cycle Diesels are direct connected to two 270 kw. generators

Characteristics of N. Y. Central Towboat

Length overall	108 ft. 0 in.
Length b.p.	96 ft. 0 in.
Beam, molded	26 ft. 0 in.
Depth, molded	13 ft. 3 in.
Power	650 s.hp.
R.p.m.	115-145
Number of generators	2

At the forward end of the bridge house is a large wheelhouse with entrance ladder and doors at the aft end and not in the side, as is usual in most towboats. This wheelhouse contains controls to the main propelling motors, a steering wheel and compass. There is on top a fire-fighting monitor operated by a 75 hp. electrically driven fire pump. Exhausts from the two main engines are led up into a large stack of flat oval section. A small lifeboat is mounted on davits abaft the stack. This actually is in excess of steamboat inspection requirements, which make it compulsory now for all steam tugs to carry their boats in davits, but make no ruling in the subject of motortugs. No wooden fenders are arranged around the ship's side, but a special steel fender, which is, in fact, a continuation of the sheer strake, is arranged for this purpose. Generator sets are located amidships and the main propulsion motor is aft.

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Diesel Towboat's Low Operating Cost

New Vessel Engaged in Coastwise Towing and Operating Continuously for 2 Months Shows Remarkable Economy

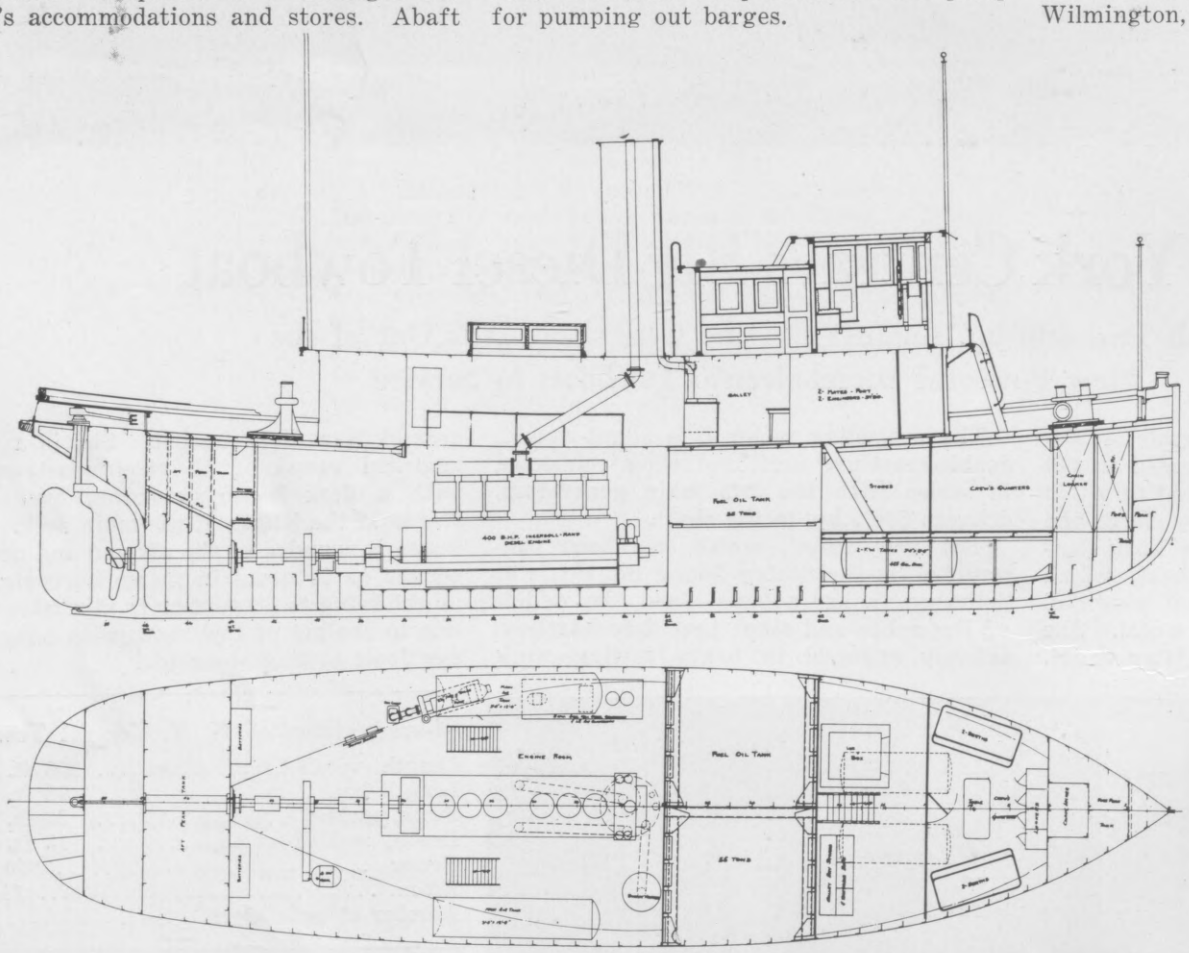
COASTWISE towing at an average of less than 16 cents a mile has been realized with the Diesel tug SAMSON, completed recently by the Spedden Sb. Co., Baltimore, Md., for G. F. Pettinos. She is powered with a 6-cylinder 400 b.hp. Ingersoll-Rand Diesel, and is a steel towboat of conventional type, designed especially for handling tows of barges coastwise, north and south from Philadelphia and Baltimore.

The hull is divided into five watertight compartments. The forward compartment contains water ballast and the chain locker, the second compartment is arranged for crew's accommodations and stores. Abaft this comes a third compartment which carries 55 tons of fuel oil, abaft of which, again, is the machinery space. The fifth compartment, or aft peak, is a water ballast compartment.

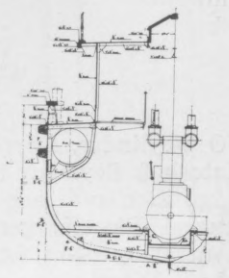
The deck house has four berths forward, a galley and a mess room, and is also the engine room casing. Enclosed in a compartment at the aft end of the deck house is an electric hawser puller. This is not an automatic towing machine, but is actually an electric winch for quick handling of heavy tow ropes. On top of the deck-house is a roomy pilot house and captain's cabin. A 14 ft. life boat is carried in davits on the port side. Access to the house top from the main deck is by steps at the forward end.

The main 400 b.hp. Ingersoll-Rand Diesel in the engine room drives a circulating water and ballast pump, two lubricating oil pumps and a maneuvering air compressor. It is thus an entirely self-contained unit, and although direct coupled to the propeller its maneuvering ability leaves nothing to be desired. Indeed, the machinery equipment as a whole is a splendid testimony to the efficacy of the direct-connected Diesel for towboat propulsion.

Auxiliary machinery is complete and compact. A 3-cylinder Hill Diesel direct connected to a 12 kw. generator and a 2-stage compressor forms an emergency set. An electric motor drives a 2½ in. Morris centrifugal fire and bilge pump. This has a capacity of 250 gal. per min. at 50 lb. pressure. Connection is provided on this pump for pumping out barges.



General Arrangement



400 hp. Diesel Towboat Samson

Characteristics of Tug Samson

Length on deck	87 ft. 0 in.
Length b.p.	79 ft. 0 in.
Beam molded	21 ft. 0 in.
Depth molded	11 ft. 6 in.
Draft (mean)	9 ft. 0 in.

For supplying electric power when the ship is under way an 8 kw. generator is connected to the main shaft by means of belting. For fuel oil transfer service there is a 35-gal. per min. pump driven by a 1 hp. motor, and also a rotary hand pump for standby purposes. A 100-cell 110 volt storage battery is fitted for use when neither of the generators is in operation.

There is nothing exceptional about the construction of the tug which calls for special notice except that she has been built with scantlings in excess of the requirements of the classification societies. She was designed by M. C. Furstenau, naval architect of Philadelphia.

Since leaving the shipyard she has been in practically continuous operation. Her first tow was moving an 8000 bbl. oil barge loaded from Philadelphia to Wilmington, N. C., and Brunswick, Ga. She left Delaware Breakwater with the loaded barge in tow at 7 a.m. on November 1, arriving at Wilmington on November 3; unloaded and left Wilmington November 4; arrived in Brunswick, Ga., November 5; loaded and left Brunswick November 6. She arrived in Wilmington, N. C., on November 8; unloaded and left Wilmington November 9, arriving at Brunswick November 11.

Due to a heavy northeast storm she lay in Brunswick until November 15 about noon; arrived at Wilmington, November 17; unloaded and left November 18; arrived Brunswick November 20; loaded and left November 21; arrived Wilmington, N. C., November 22; unloaded and left November 23, and arrived in Philadelphia the evening of November 25.

This called for her making a total of approximately 3000 miles from the time of leaving Philadelphia until arriving back again on the night of November 25 and at all times she was towing this same barge, either light or loaded, as indicated above.

During this period of time the total fuel consumption was approximately 8000 gal., which at the current price of fuel oil of 6 cents per gal. averaged a total fuel cost of less than 16 cents per tow-mile.

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Another Big Standard Oil Conversion

Tanker E. T. Bedford Has Been Thoroughly Modernized by Removal of Steam Machinery and Substitution of Diesels

COMPLETE modernization of the Standard Oil Co.'s tank ship E. T. BEDFORD has been effected by the removal of the whole of the steam reciprocating machinery — of 3700 i.hp. — and boilers with which she was built and the substitution of two Busch-Sulzer Diesels of 1500 b.hp. apiece. This work, which has involved the corresponding modernization and re-arrangement of the whole of the auxiliary machinery was completed by the Federal Sb. Co. at their Kearny, N. J., plant early in December. After carrying out a short trial, the vessel was commissioned immediately and is now engaged in coastwise transportation of fuel oil from Gulf ports to New York.

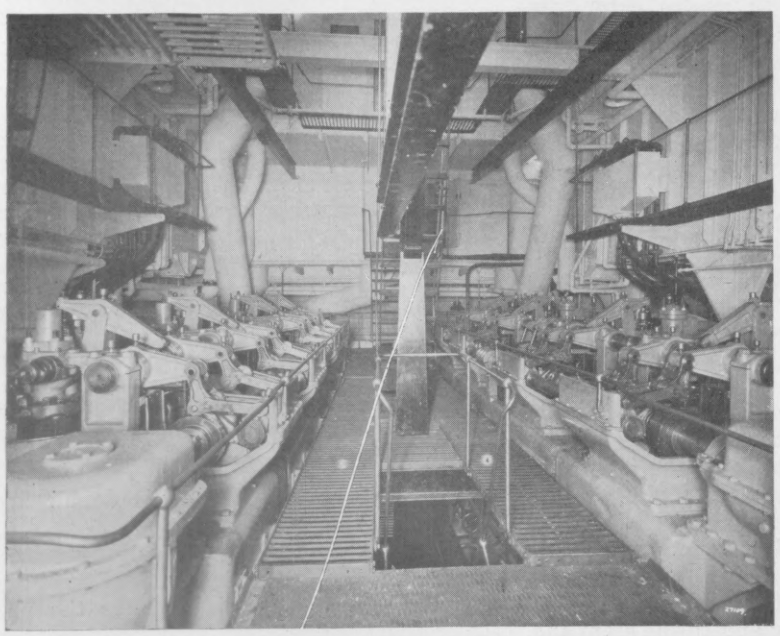
MS. E. T. BEDFORD is a comparatively new ship having been constructed by the Federal Co. in 1921. She is one of the largest and finest ships in the Standard tanker fleet. With the new hull, which had been kept in good condition, there was very little work to be done in converting, and the question resolved itself therefore mainly into a question of taking out the whole of the existing propelling machinery and its auxiliary equipment and the substitution for it of the Diesel machinery and its equipment. This is in distinct contrast to the work done on the Shipping Board conversions in which the whole ship had to be modernized. As it is, the principal structural work involved has been the arrangement of a boiler room flat at the forward end of the new engine room. Among other modern features on the vessel as she is at present are a Sperry gyro-pilot outfit and an exceptionally complete Lux fire extinguishing system.

Characteristics of Ms. E. T. Bedford

Length b.p.	499.2 ft.
Beam, molded	68.1 ft.
Depth, molded	30.5 ft.
Gross tonnage	9563 tons
Net tonnage	5978 tons
Power	3000 b.hp.
Number of main engines	2

The two main engines are of 4-cylinder type generally similar to the four units of 3000 b.hp. to be installed in Shipping Board conversions. They are rated at 1500 b.hp. each and have the same bore of cylinder as the Shipping Board units—30 in.—but a slightly shorter stroke. Each engine drives a 4-blade 15 ft. 0 in. diameter manganese bronze propeller. A 3-stage air compressor is attached to each engine at the forward end of the crankshaft.

Auxiliary machinery is electrically driven, steam being retained to drive the cargo oil pumps, heat the tanks and operate one or two standby auxiliaries. For the electrical auxiliaries there are two 50 kw. generator compressor sets and one 100-kw. generator set operated by Nelseco Diesels.



Cylinder tops of the two 1500 *hp. main Diesels*

Control platform is at engine room ***floor level***

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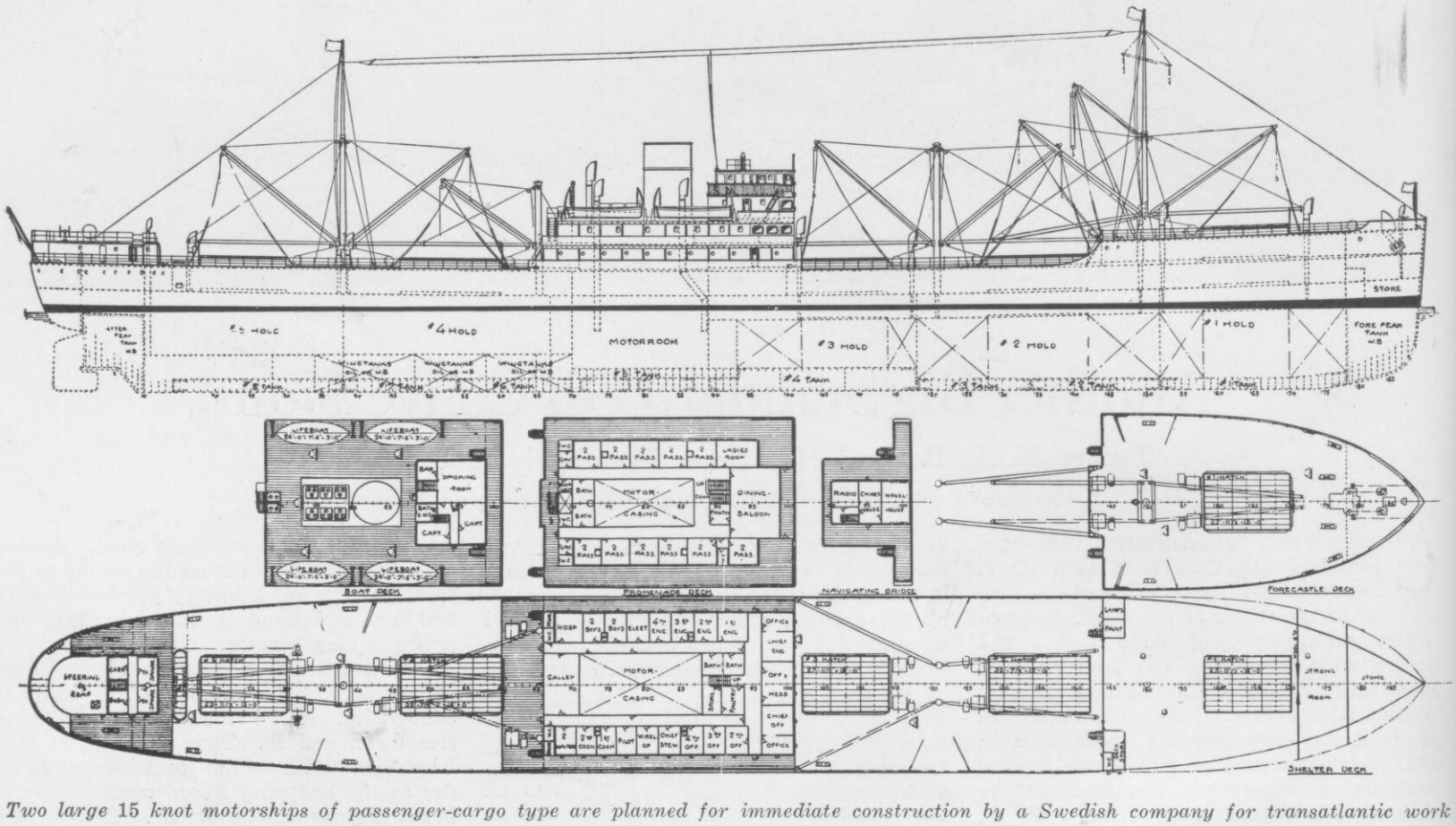
Two 9000 Ton 15 Knot Swedish Motorships

CONSTRUCTION of two motor cargo and passenger liners was determined at a recent meeting of the Transatlantic Steamship Co., Ltd., Gothenburg, and orders have been placed at the Gotaverken Yard to go ahead immediately with two vessels of about 9000 tons dw., to be equipped with Diesel engines of 6400 i.hp. which will give them a full load service speed of 15 knots. These vessels, as the outboard profile indicates, will be of passenger-cargo type, having in all five cargo holds fitted with center line divisions for the carriage of grain. Large hatches 18 ft. wide will serve each of these holds and quick discharge of cargo will be taken care of by 14 electric winches. The ships will have an overall length of 455 ft., a beam of 57 ft., and a depth molded of 39 ft. 10 in. Structurally they will be of shelter-deck type, but a special feature will be a very long forecastle which will have on it the hatchway to No. 1 hold. This is an arrangement not usually found. It has been adopted in the motorships CASTILLIAN PRINCE and BRAZILLIAN PRINCE, now operating in the South American trade from New York for Furness-Withy & Co. Below the shelter-deck is one complete 'tween-deck and below this again a lower 'tween-deck on the forward side of the motor-room only. A midship house contains accommodations for deck and engine officers at shelter-deck level, while on the promenade, according to the present stage of the design, there are accommodations for 22 passengers in 11 double-berth cabins. A full-sized stack is fitted above the bridge structure, and this in conjunction with the straight stem, long forecastle and cruiser stern, gives the vessels a very handsome appearance.

Gotaverken Plant, Gothenburg, has built several motorships for Transatlantic Co.



Two large 15 knot motorships of passenger-cargo type are planned for immediate construction by a Swedish company for transatlantic work

War Department's New Diesel Tug

DIESEL-ELECTRIC propulsion is to be used for a new towboat of moderate draft to be built for the War Department for work in the harbors of Mobile, Ala., Pascagoula, Miss., and Gulfport, Miss. Bids are now being taken for this work. The tug is to be driven by a 400 hp. electric motor, operated from the pilot house, taking current from generators driven by two Diesels of about 250 hp. apiece. The main propelling motor is to be of shunt wound open type, delivering its power at between 160 and 230 r.p.m. Two armatures, each wound for 125 volts, will normally operate in series. Control for the main motor in the pilot house will comprise two inter-connected engine room telegraph type controls, one of which contains the master switch for operating the control rheostat.

The vessel will have a normal towboat type hull and outboard profile, except that two exhaust pipes will be fitted in place of a full-sized stack. Framing is to be on the transverse system, and the main frames are of 4 in. x 3 in. x 5/16 in. angles, extending in one piece from keel to main deck. Heel pieces 16 in. long, of 4 in. x 3 in. x 5/16 in. angles are fitted over the keel to connect the heels of frames on opposite sides together.

Reverse frames are 3 in. x 2½ in. x 5/16 in. angles in engine room, and 2½ in. x 2½ in. x ¼ in. angles forward and aft of the engine room, fitted on every frame. Reverse frames in the engine room extend to the lower stringer, while forward and aft of engine room they extend horizontally from side to side of the tug.

The stem is of flat bar rolled from open hearth steel ingots, 1¼ in. thickness and 5¾ in. width throughout, with the forward edge rounded above the 5 ft. water line. It is scarfed to the bar keel, the length of scarf being 18 in. Plating is double zig-zag riveted to stem.

The keel is of flat bar rolled from open hearth steel ingot, 1¼ in. thickness and 5¾ in. width throughout, and in lengths connected to each other and to the stem and stern post by planed scarfs not less than 18 in. long. Scarfs are located to clear the butts of the garboard strakes by at least two frame spaces. Plating is double zig-zag riveted to the bar keel.

The stern post is a steel casting made in one piece. The propeller post is of solid section 5 in. by 2½ in. bossed for the propeller shaft.

Characteristics of War Department Tug

Length, b.p.	97 ft. 0 in.
Length overall	100 ft. 0 in.
Length overall, molded	101 ft. 0-13/16 in.
Breadth, molded	22 ft. 0 in.
Breadth, overall	22 ft. 7¾ in.
Depth at side, molded	10 ft. 6 in.
Depth at center line, molded	10 ft. 11½ in.
Sheer forward at center line, molded	4 ft. 0½ in.
Sheer aft at center line, molded	2 ft. 4½ in.
Camber in 22 ft. 0 in., molded	0 ft. 5½ in.
Draft, forward	7 ft. 3½ in.
Draft, aft	8 ft. 0 in.
Power, main motor	400 b.hp.
Speed of motor	230 r.p.m.

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Large Diesel Dredge for Panama Canal

Modern, Well-equipped, 28 in. Pipeline Dredge Featured in New Construction to Be Undertaken for the Canal

POLICY of the Panama Canal Authorities in keeping consistently up to date in choice of equipment upon whose efficiency depends the efficiency of the Canal as a whole is reflected in bids which they are taking this month for the construction of a powerful Diesel-electric pipeline dredge.

The main power plant of this ship is to consist of four Diesel generators, three of which at any time must be capable of furnishing power for a normal, full-load operation of the dredge with the fourth serving as standby. These three units will supply current for an electric motor driving a centrifugal, single-suction pump, with 26 in. diameter suction and 24 in. diameter discharge.

Heavy duty will be required of the vessel, and she is to have an output of 2200 cu. ft. per min. of a mixture of water and solids, with an average density of 75 lb. per cu. ft. She is to be designed for operation in the Panama Canal or adjacent waters, either fresh or salt, and is required to dredge to a depth of 60 ft. and to deliver into a floating discharge pipeline. Furthermore, the vessel must be able sufficiently to dredge in one swing a cut 250 ft. wide at the full depth of dredging.

Hull Characteristics

The hull dimensions are to be a minimum to accommodate the dredging machinery required for these conditions, but the maximum freeboard with the dredge in full load working condition must not be less than 4 ft. 6 in. Transverse framing is to be adopted with the spacing not greater than that required by the American Bureau of Shipping, while shell plating is to be 5 lb. per sq. ft. heavier than that required by the same body. Deck and bulkhead plating is to be in conformance with American Bureau's requirements.

Hull shape is, in general, in conformity with that of most modern pipeline dredges. Bilges are to be rounded and a square stern will be fitted, except that the stern corners are to be rounded to a radius of over 24 in. The stern will also have a rake ending 4 ft. vertically below the main deck to facilitate towing. The bow is to be tapered to facilitate dredging at close quarters against a vertical bank. Two longitudinal watertight bulkheads are to be worked into the hull structure, each 7 ft. from the side plating. The interior arrangement of the hull as to location of other bulkheads will, naturally, depend on the dimensions of the main machinery, and the arrangement is left to the judgment of the contractor in preparing the design.

The general aim in addition to providing a strictly strong and stiff hull, is to provide against disaster to electrical or other machinery by reason of rupture of hull pump casing or pipelines. For this reason the main dredge pump, the main driving motor and each pair of the four prime movers, together with their corresponding generators and exciters and the main switchboard, are to be placed in separate compartments, watertight at bottom and sides. Furthermore, no doors are to be used in the bulkheads between these compartments. A double bottom at least 24 in. in height is to be installed under the main motor, the switchboard and the two Diesel engine rooms.

Machinery wells are to be covered by a steel house with steel roof, the height of which depends on the head room required for handling ordinary repairs and parts with the travelling crane. A walkway 7 ft. wide on the main deck around this house must be arranged, for at the forward end on top of this roof, which forms a second deck, the operating room will be located. In this room will be complete control of all operations of the dredge except that of the main Diesel engines and auxiliary pumps. A master gage board will be located here and will contain indicators for all necessary control.

Living quarters for crew will be on the second deck abaft the operating room. This will be installed by the Canal Authorities.

The spuds are to be square in section and of suitable strength and size for operating in a 3-knot current, allowing also for standard wind loads.

The main switchboard, which will be located in a separate watertight compartment, is to be of dead front type, with the main generator and auxiliary generator switches operated by hand wheels on the front of the panels. A 230 volt cutter motor of watertight, separately ventilated type is of sufficient horsepower rating to drive the cutter continuously under the dredging operations specified. The power of each main Diesel will be such that three units will satisfactorily operate the dredge with necessary auxiliary machinery, the fourth unit acting as standby. A piston speed of 950 ft. per min. with a mean indicated pressure for 4-cycle units of 90 lb. per sq. in. and for 2-cycle units of 80 lb. per sq. in. is not to be exceeded.

Engine Vibrations

The engine manufacturer must guarantee his engines against critical, torsional or any other forms of vibration between limits of 70 per cent and 120 per cent of the standard full-load speed, both on shop test and after installation in the dredge. Torsiograms must be taken during ship tests.

Each engine is to be a complete unit, including lubricating apparatus, injection system, mufflers, air starting device. A complete auxiliary machinery equipment is to be installed, comprising generator-compressor units, motor-driven compressor, fire pumps, bilge pumps, circulating pumps, sanitary pumps and fuel oil transfer pumps. There will also be an ice-machine and a well-equipped workshop.

It should be noted in connection with this dredge that respective bidders may submit one of four propositions. The first proposition calls for the supply of the complete dredge; the second requires the supplying of the whole of the machinery in the vessel but not the hull; the third proposition takes in the dredging machinery, including the hull fabricating, ready for erecting and riveting, but excluding Diesel engines, motors, etc., and the fourth proposition is for dredging machinery exclusive of hull and electrical equipment.

Diesel Sternwheel Survey Boat

Direct Diesel drive has been selected for the propulsion of a steel sternwheel survey boat shortly to the constructed for the Army Engineers for service on the Mississippi. The main engine will be a 2-cycle, airless injection engine of about 220 b.hp., fitted with direct reversing and air starting mechanism, ball thrust bearing, variable speed injection pump, eccentric driven circulating, bilge, fuel oil service, and forced lubrication oil pumps, oil cooler and 2-stage air compressor. The weight of the engine is about 19 tons.

Transmission of power from engine to stern paddle wheel is through shafting, two speed reducing steps of silent chain drive within the hull, and a bevel gear drive at the wheel shaft. For a main engine speed of 325 r.p.m. the successive speed reductions are approximately: first chain 2 to 1, second chain 2 to 1, and gear drive 3 to 1; the speed of the paddle wheel being 26 r.p.m.

Characteristics of Mississippi Survey Boat

Length overall	139 ft. 6 in.
Length on deck	120 ft. 0 in.
Length on 2 ft. 6 in. waterline	117 ft. 0 in.
Beam, molded	24 ft. 0 in.
Depth, molded	5 ft. 3 in.
Sheer, forward	2 ft. 10 in.
Sheer, aft (hull)	1 ft. 0 in.
Displacement on 2 ft. 6 in. draft	166 tons at 2,000 lb.
Power, about	220 b.hp.

A line shaft runs from the engine aft to a chain drive well, where the first chain drive leads to a counter shaft on the port side of a sunk deck. From the counter shaft the second chain drive leads to the gear shaft on top of the center wheel beam. The gear shaft runs aft to the paddle wheel shaft where the bevel gear drive is fitted.

The paddle wheel is of radial, fixed paddle, split type, each half 16 ft. diameter and 8 ft. 6 in. long over buckets. For each wheel there are three sets of arms, bolted to steel-casting wheel flanges, wedged to the wheel shaft, with 12 arms to each set. The arms, buckets and segments are of well seasoned white oak, and the braces of poplar. A 4 in. x 5/16 in. bar steel circle is fitted on each side of each segment and bolted together through the arms and segments.

A guard is built forward, 16 ft. wide at the stem, the side line running into the hull line at frame 16. The guard is supported partly by through beams and partly by plate brackets.

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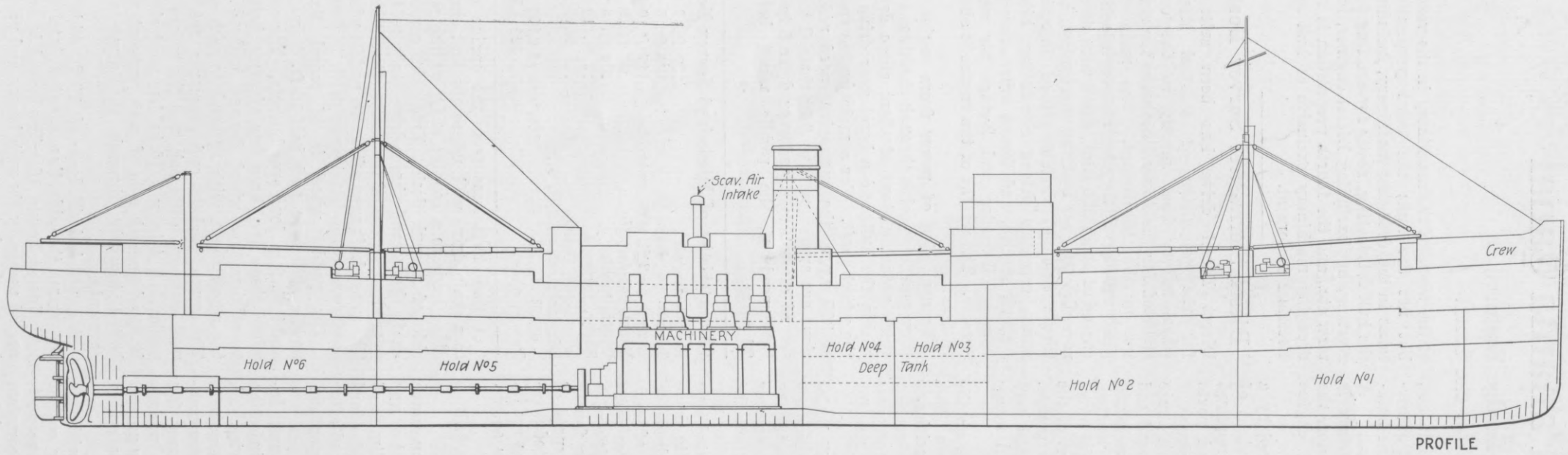

Outline general arrangement of big Diesel driven freighter Silverash shows her as a well equipped ship with all facilities for handling general cargoes of Far Eastern type

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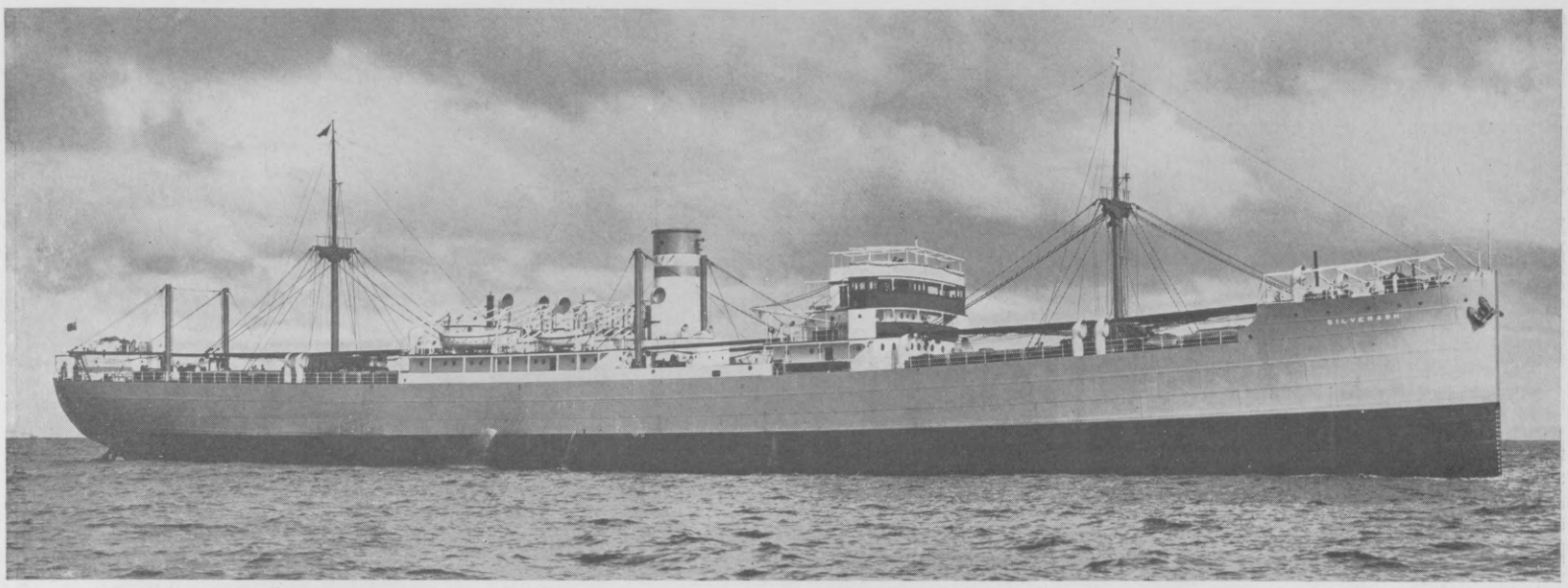

Ms. Silverash, Round-the-World Freighter

Is First of Fleet of New 14 Knot Motorships Engaged in the Transportation of Far Eastern Cargoes

MS. SILVERASH, first of a fleet of six new high-class motor freighters which have been constructed for the service from New York to the Far East maintained by Kerr Lines, Inc., New York, sailed towards the end of last year on her maiden voyage. She was constructed in Sunderland, England, by Jos. L. Thompson Co., and is powered by a 4-cyl. Doxford opposed-piston Diesel, having a normal rating of 5000 b.hp. which can be increased if necessary to 5500 b.hp. SILVERASH is expected to maintain a service speed of about 13 knots fully laden, and has been constructed with a view to a maximum speed of about 14½ knots. She and five sisters, four of which are now completing, will thus be entirely suitable to run in competition with the five first motor freighters which were put on the New York-Far East service by Furness Withy early this year. They will replace, moreover, an existing fleet of 11½ knot Kerr Line motorships which are to be transferred from the New York service in which they have been running to the Pacific Coast. Operating from San Francisco and Los Angeles to Yokohama, Kobe, Shanghai, Manila, Soerabaya, Samarang, Batavia and Singapore and back, they will constitute a valuable addition to the fleet of well-equipped motor vessels in transpacific service. The maiden sailing of this new service is with MS. SILVERLARCH on Jan. 10.

Trade from New York to the Far East is of such increasing importance that the most modern means of transportation have to be provided. This the motorship can give. Vessels engaged in this trade load a general cargo at New York, and call for additional cargo at Norfolk and, in the case of Kerr Lines, Savannah, and also at San Pedro. From San Pedro they cross the Pacific straight to Japanese ports, proceeding thence to Manila, which is considered the terminating point of the outward voyage. Here much valuable cargo is picked up, chief among which is latex, and coconut oil in bulk, both of which require special tank holds with heating appliances. Outward cargo is dropped at all points up to Manila and homeward cargo is also picked up. After leaving Manila the vessels proceed to various points in the Dutch East Indies as cargo offers, and then make the homeward voyage back to New York via Straits Settlements, Colombo, and the Suez Canal.

A voyage like this is a long one which includes changes of climate, changes of weather conditions, and is in many ways exacting. It requires, in fact, the highest type of cargo vessel and for this work the Diesel-engined ship is peculiarly suitable. Aside from the superior economy of the prime mover itself, which is no small factor, the smaller bunker space required leaves more room available for freight, while the ease and rapidity with which fuelling can be carried out obviated delays other than the time necessitated by cargo handling itself, and here again the efficiency of a motorship's electric cargo-handling appliances does much to speed up the time in which a round trip can be accomplished. This round-the-world service at the present time is one of the most keenly competitive trade routes in existence, and the company which will in time handle the volume of trade is the one which has the most efficient tonnage operating on the route.

MS. SILVERASH has been especially designed for and is particularly suited to the requirements of service outlined above. She embodies modern practice in cargo ship construction, and she is an extremely fine example of a modern motorship. We noticed that in her navigational equipment electricity is used to a less extent than on some American-built ships.

Structurally the vessel is of shelter-deck type, with two tiers of 'tween decks such as is usual in vessels designed for Far East trade. The upper 'tween decks are continuous all fore and aft, while the lower 'tween decks are continuous to the forward deep tank bulkhead and aft from the aft machinery bulkhead. The construction is of the conventional transverse system of framing with cellular double-bottom all fore and aft increased in height in way of the machinery space. Strong built pillars are arranged in each of the holds and there are also fore and aft girders under each of the decks.

Eight watertight bulkheads divide the ship into nine compartments, which respectively from forward are the fore peak tank, No. 1 hold, No. 2 hold, Nos. 3 and 4 holds, which are deep tanks with a centerline bulkheads, the machinery compartment, No. 5 hold, No. 6 hold, and the aft peak tank. The fore peak tank has a capacity of 244 tons of water ballast, while the aft peak tank holds 328 tons of water. Water ballast and fuel oil are also carried in six double-bottom tanks under each of the holds, with capacities of 127 tons, 319 tons, 308 tons, 360 tons, 226 tons, and 76 tons respectively, making in all a total of 1,416 tons and totalling, including peak tanks and the two deep tanks, 4,226 tons.

Characteristics of Ms. Silverash

Length b.p.	425 ft. 0 in.
Beam extreme	58 ft. 3½ in.
Depth, molded to shelter deck	38 ft. 6 in.
Depth, molded to second deck	29 ft. 0 in.
Deadweight	9000 tons
Draft at above	25 ft. 5¾ in.
Freeboard	3 ft. 10 in.
Gross tonnage	5299 tons
Net tonnage	3091 tons
Capacity of holds (grain)	264,835 cu.ft.
Capacity of holds (bale)	243,408 cu. ft.
Capacity of tanks and 'tween dks. (grain)	361,128 cu. ft.
Capacity of tanks and 'tween dks. (bale)	324,032 cu. ft.
Power of main engine	5000 b.hp.
Service speed (loaded)	13 knots

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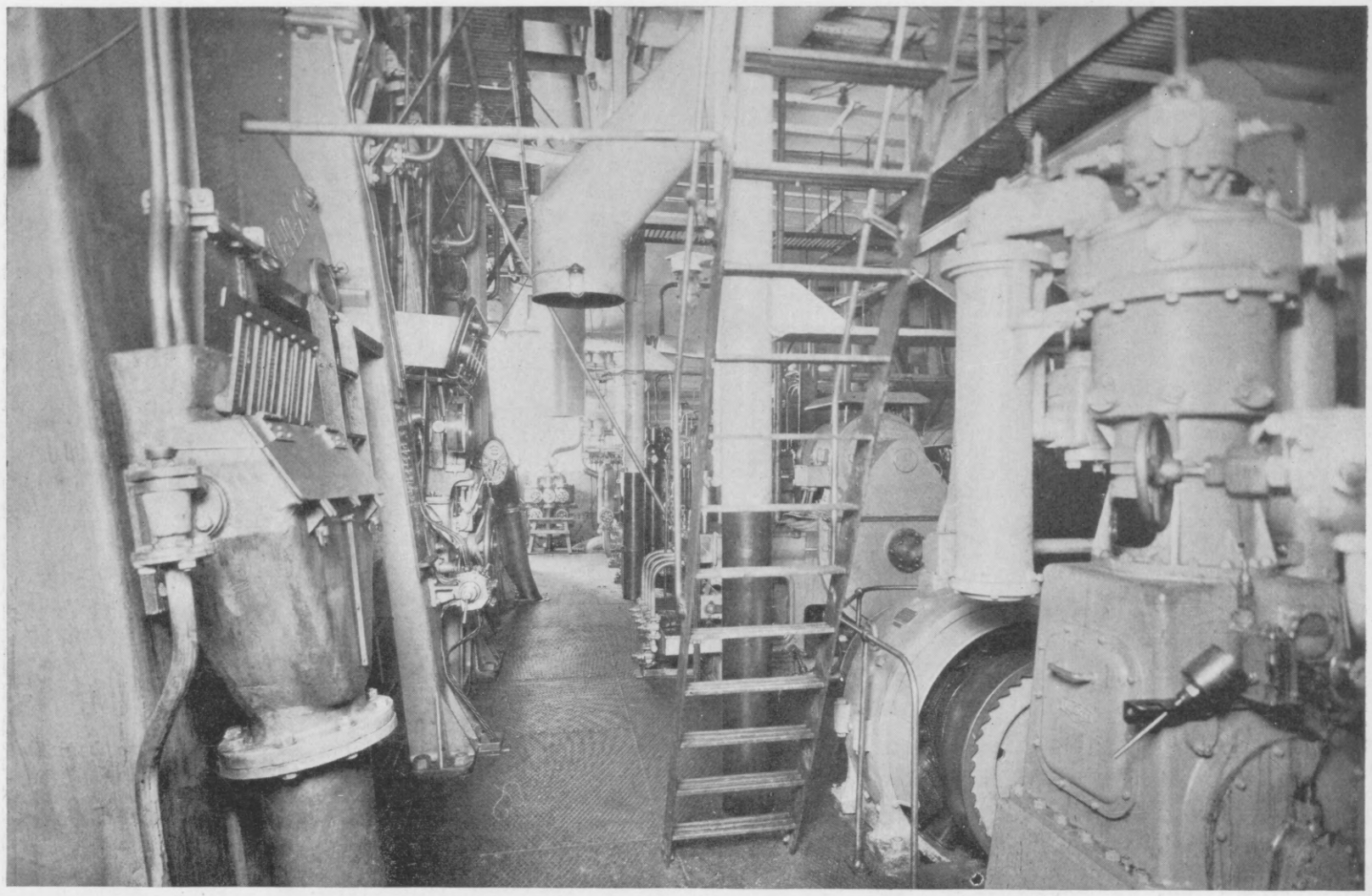
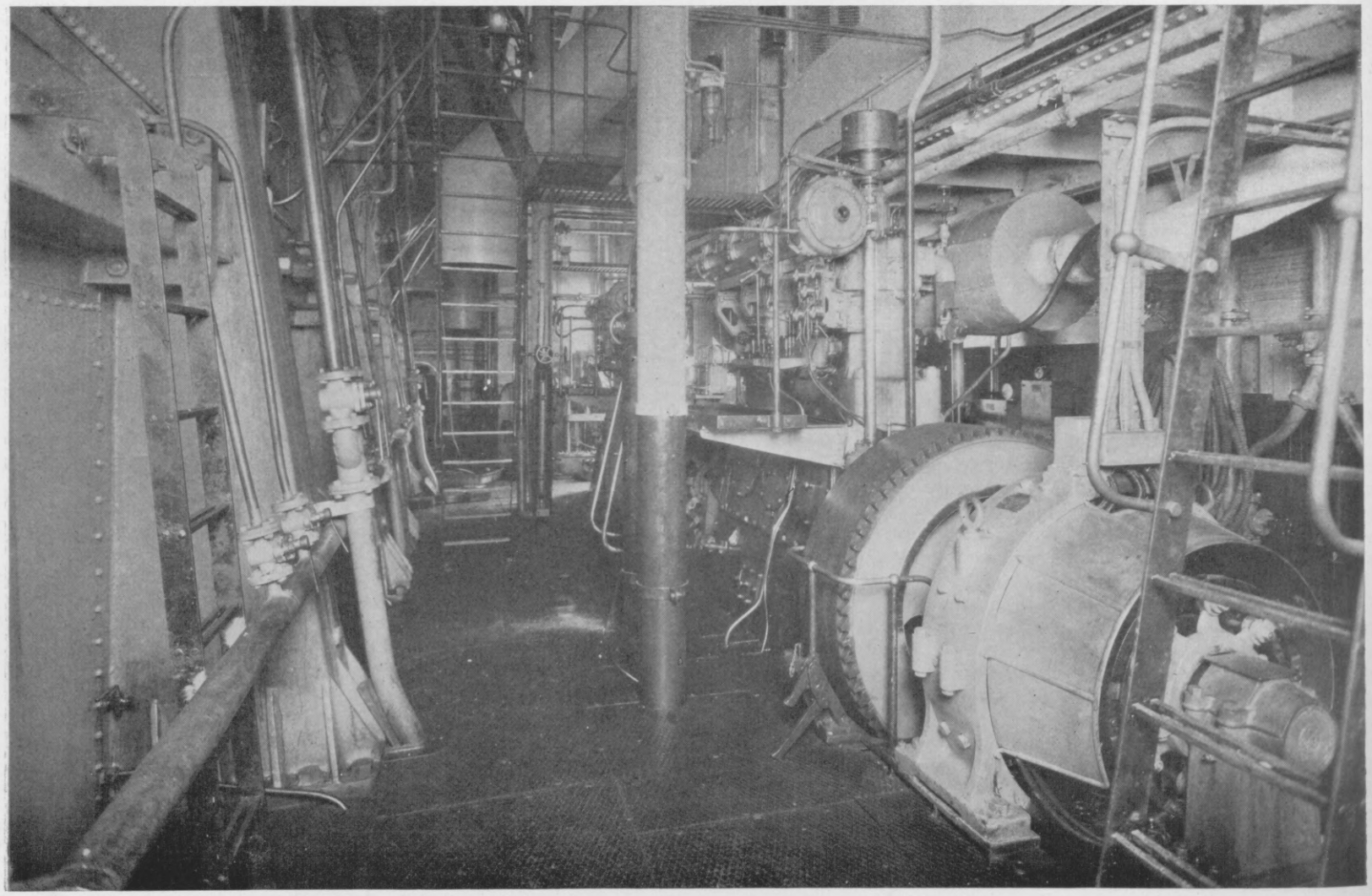


Starboard side of the roomy engine space of ms. Silverash has the controls for the main engine, maneuvering compressor and h.p. fuel pumps



Port side view of the engine space of ms. Silverash shows arrangement of two auxiliary Diesel-generator sets of 100 kw. capacity

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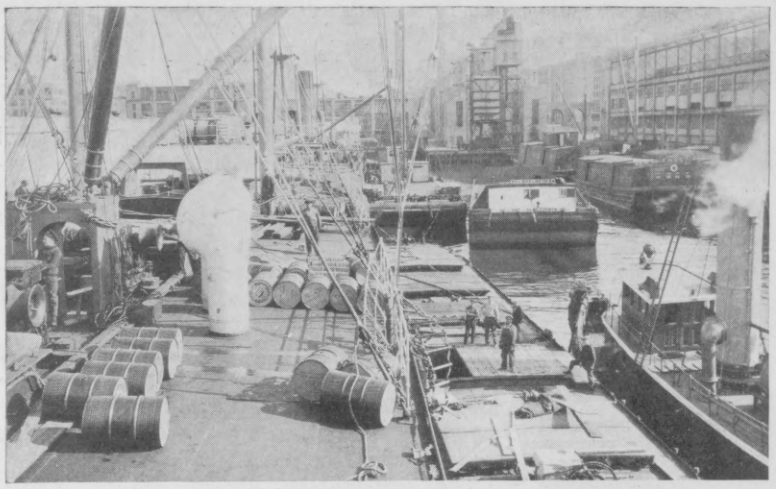
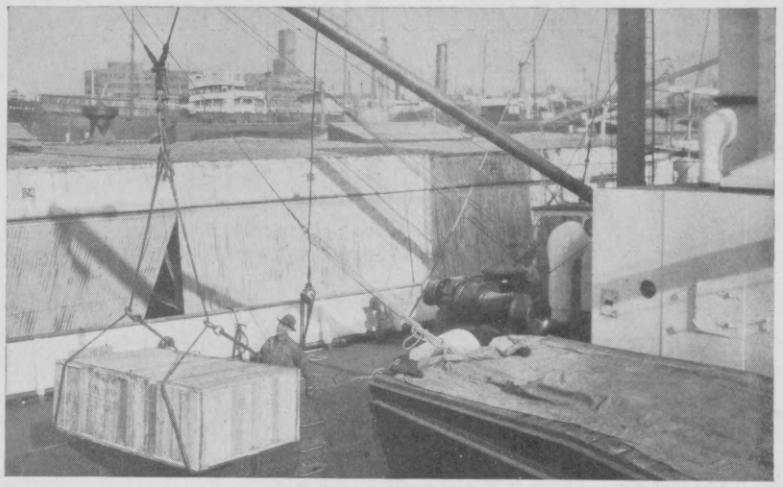


A shipment of Vacuum oil loaded at New York



Automobiles are part of Silverash's first cargo

Of the watertight bulkheads, all are continuous to the lower 'tween decks. There is a wood lining on the side of the fore peak and deep tank bulkheads facing Nos. 1 and 2 holds, this presumably being to prevent any damage to delicate or valuable cargoes through any leakage from these tanks. Similar wood lining is arranged on the face of the aft peak bulkhead which faces No. 6 hold.

Shelter deck is continuous, of course, all fore and aft, and has a tonnage opening 21 ft. long and 4 ft. wide at the aft end. Five hatchways, each 21 ft. wide on this deck, take care of the holds. Each hatch is operated by two electric winches of the type illustrated elsewhere in this article. It will be observed that these winches are not lifted clear of the deck as in the recent Shipping Board conversions, but that they are fixed at the inner ends of each of the hatchways. There are 11 winches in all.

There are on the foremast five 5-ton wooden derricks and one 10-ton steel derrick. Two king-posts abreast the stack amidships each hold a 5-ton derrick, while the main mast has a similar arrangement to the foremast and abaft this again is another pair of king-posts each with a 5-ton derrick. MS. SILVERASH is thoroughly well equipped, therefore, to take care of any kind of cargo she is likely to be called upon to handle.

Accommodation for the crew is provided in a topgallant forecastle, an arrangement which in some ships has been altered in favor of crew spaces amidships underneath the deck containing houses for the officers. In SILVERASH, light, airy and comfortable accommodations for captain and navigating officers are arranged in a house forward of the deep tank hatch. This contains on shelter-deck level comfortable cabins for chief, second and junior officers, and a well-fitted saloon. On top of this house is the captain's accommodations and a passenger cabin labelled "Owner's Room," while on top of this again is the chart house and pilot house. This contains telemotor steering gear actuating an electric hydraulic ram gear at the tiller head in the steering gear house aft. Here also are an ordinary standard compass and the necessary engine room telegraphs which are of chain and dial type. The charthouse is constructed of teak with sliding side doors. Large windows permit of easy vision ahead.

Engineer officers are berthed in side houses on the shelter deck alongside the engine casings. Cabins are provided for a chief engineer, 9 assistants and an electrician. Here are also engineers' mess, quarters for four cadets, the refrigerating machine and cold storage rooms for vegetables and meat, in addition to the storage space for CO_2 bottles for the Lux fire extinguishing system. A small structure aft houses the steering gear which we have alluded to already and contains the electricians' store and paint room.

The main propelling engine, comprising a 4-cylinder opposed piston Doxford Diesel, with cylinder diameter 26¾ in., and combined stroke about 107 in., is located slightly abaft amidships. The scavenge pump for the main engine is arranged centrally between the pairs of cylinders and air is taken in from a special intake on top of the midships house. As the illustrations indicate the machinery space is roomy and advantage has been taken of this to make an efficient layout.

All the auxiliary machinery is electrically driven, and there are for supplying the necessary current three-100 kw. generators, each driven by single-acting 4-cycle Diesels of B. & W. type. Two of these are located on the port side and one on the starboard side. On the port side are arranged work shop machinery, a general service pump, bilge pump and oil fuel transfer pump. Here is also a vertical heating boiler of 500 sq. ft. heating surface, with its necessary auxiliaries. On the starboard side there are two maneuvering air compressors. These are Weir 3-stage units, one driven by a 90 hp. motor and the other by a 50 hp. motor, each running at 350 r.p.m., the former compressing 300 cu. ft. of free air per min. to 600 lb. per sq. in., and the smaller dealing with half this quantity.

The starboard wing of the engine room contains also an auxiliary high-pressure fuel oil pump for the main engine, two jacket water pumps of vertical type with the main motor directly above the centrifugal pump. The motors are 30 b.hp. units running at 975 r.p.m. and having a capacity of 200 tons per hour.

At the forward end of the engine room on the starboard side is the third 100 kw. generator, two forced lubrication pumps, a sea water pump, circulating water pump for the generator sets, another jacket water-cooling pump and a piston water-cooling pump.

The main switchboard is situated on the starboard side of the ship, parallel to the ship's side and near the third 100 kw. generator. An emergency compressor generator unit is arranged at the forward end of the engine room alongside the bulkhead.

Sharples centrifuges are provided to take care of both fuel and lubricating oil, there being a battery of three machines for this purpose, two of which deal with fuel oil and one with lubricating oil. These are arranged alongside the thrust block on the starboard side of the thrust recess.

The exhaust gases from the main and auxiliary Diesels are used for heating purposes. Gases from the main engine pass through an exhaust heater on their way to the stack, and those from the auxiliary Diesels pass through an auxiliary waste-heat boiler, 3 ft. in diameter and 10 ft. 5¼ in. high. The overall length of engine room is stated to be about 62 ft., which includes the 13 ft. of thrust recess.

Motor Meat Carriers

Nelson Line London is reported to be contemplating immediate construction of five insulated motor ships for carrying passengers and frozen meat between the River Plate and London. These ships will be fast vessels of 15,000 tons each and will in all probability be built by Harland & Wolff and powered by H.&W.-B.&W. double acting 4-cycle Diesels.

Nelson Line at present operate a fleet of 12 steamers of between 6000 and 10,000 tons on this service, the oldest of which was built in 1904 and the newest in 1920. They have a speed of about 12 knots maximum. It is clear that a fleet of this nature is not the best for active competition in such an exacting trade as meat carrying, especially in view of the fact that the Blue Star line which also operates in this trade from Liverpool is constructing nine fast modern steamers. Blue Star Line, it is understood, originally contemplated fitting Diesels to its new fleet, but more conservative counsels prevailed and geared turbines are the result. Nelson Line, which belongs to the group of companies controlled by Lord Kylsant, has very naturally considered the Diesel as the best form of prime mover for its new ships.

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Electric Drive Saves $2707

DURING the month of September, 1926, Diesel-electric dredge SANDMASTER, owned by Construction Materials Co., Chicago, operated alongside a steam dredge SANDCRAFT, performing approximately the same work. This operation gave an excellent opportunity for comparing operating costs on a fair average basis, and showed that fuel and labor costs for the Diesel-electric dredge were $2,707 less than for the steamer, which, if capitalized, is equivalent to a 6 per cent per annum rate on $541,448. In addition to the monetary savings, an anticipated saving in fuelling, time, starting, stopping and getting under way, and in making adjustments were realized.

Both ms. SANDMASTER, which formerly was the sea-going freighter ss. LAKE WEIR, and the steamer SANDCRAFT are of interest because of the unusual service in which they are employed. In addition to transporting sand and gravel, the vessels are equipped with combined loading and unloading sand pumps, which are piped in a manner unique to these vessels. They suck sand from the bottom of the Great Lakes into the ship's hoppers and when the vessel reaches her destination the pumps are again used for unloading, covering effectively a wide range of capacity and pumping heads.

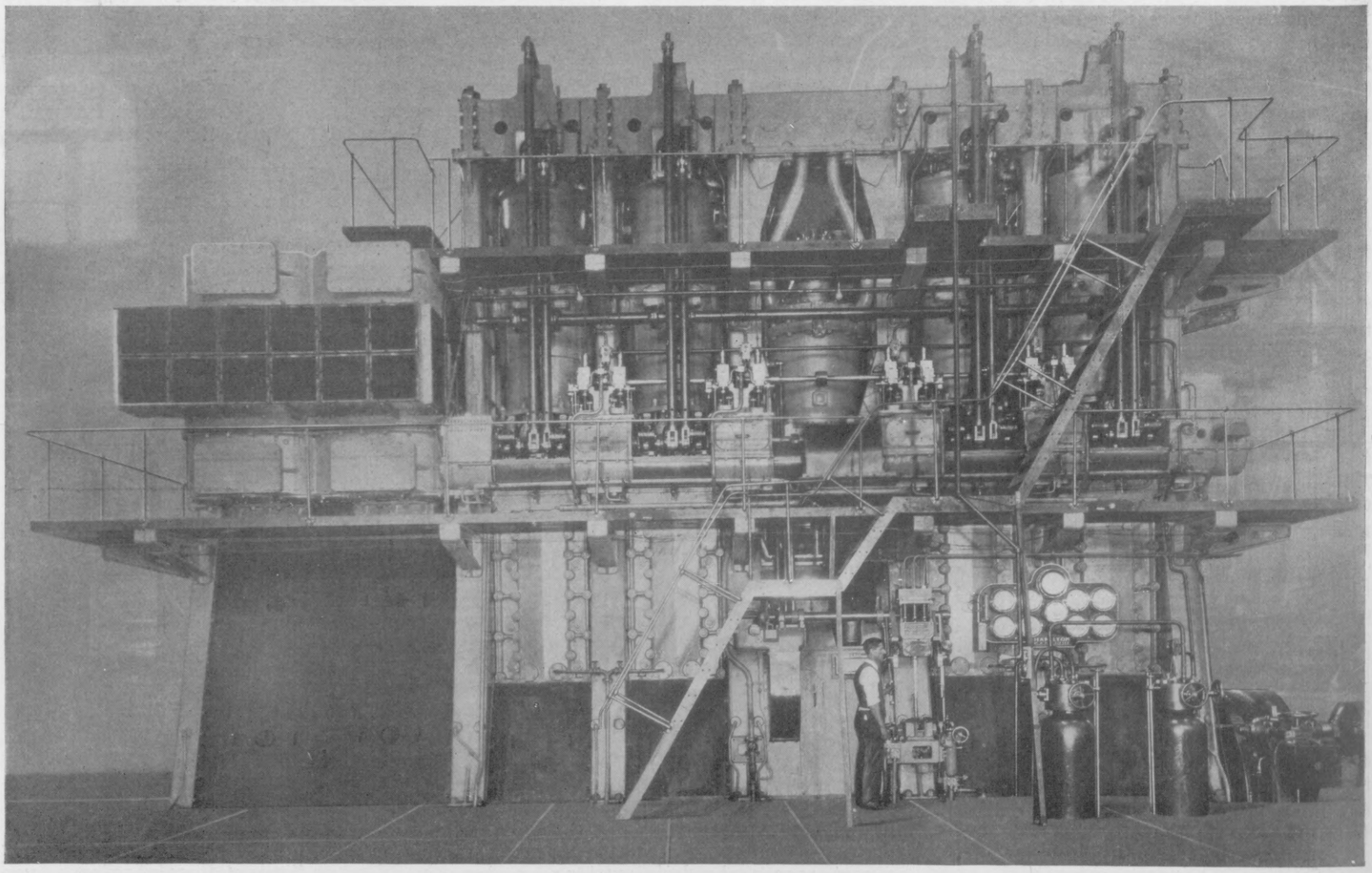
Diesel-electric dredge Sandmaster making a sand fill at Chicago

This method of loading and unloading had its origin with the making of the sand fill for the Marshall Field Museum, Chicago. Various methods had been tried without success to make a suitable fill to serve as a foundation for this structure, the site of which was previously covered with water to a depth of 16 ft.

J. R. Sensibar, of the Construction Materials Co. conceived the idea of loading sand into vessels by means of pumps, transporting the sand by these vessels to Chicago and then pumping the sand from the boats to the area to be filled.

The illustration shows dredge SANDMASTER at work on a sand fill for the South Side Parking Commission, on the lake-front at Chicago. A second pipeline and set-up ahead of ms. SANDMASTER is that at which the steamer SANDCRAFT has been working, showing how closely parallel these two vessels operated during the months of September and October. The picture, which was taken on Oct. 22, shows the speed with which sand fills are made by the Sensibar method. At the time when the fill was started, Aug. 27, the area to be reclaimed was covered with water 14 ft. deep.

Ms. SANDMASTER is one of the most completely equipped Diesel-electric freighters in commission. Two 600 hp. Worthington 4-cycle Diesels drive generators which supply current to General Electric motors for propulsion and pump-driving purposes. The ship has been described in MOTORSHIP.



Hooven Owens Rentschler are running tests with this 4-cylinder double-acting 2-cycle Diesel of 3050 hp. built for the Shipping Board

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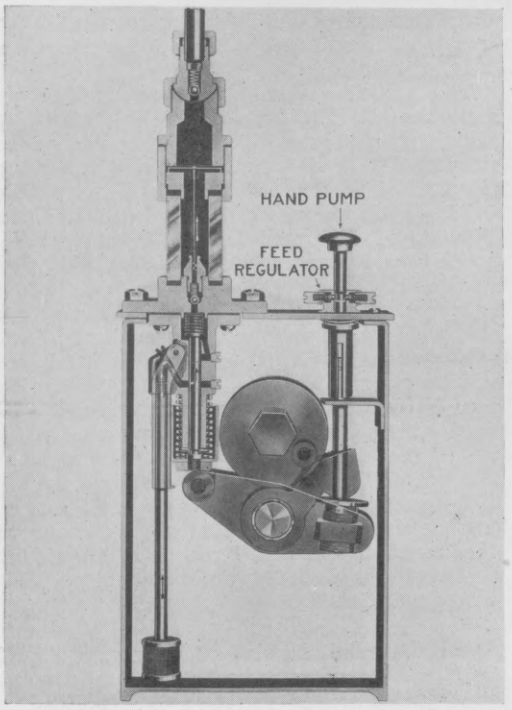
New Pattern Lubricator for Diesels

Improved Model Permits Individual Pump Unit Removal at Any Time Without Stopping the Whole

CONSTRUCTED with individual pumping units fastened to the top cover of the oil reservoir and designed so that any individual unit may be removed at any time without stopping the engine, emptying oil from the reservoir, or interfering with the operation of the other units, a new pattern Manzel lubricator is now available to users of Diesel engines.

The new model—No. 82—embodies all features of the previous model—No. 77—which was placed on the market by Manzel Bros., Buffalo, a number of years ago, in addition to the improvements outlined above. It is designed to time the injection of oil into the engine cylinders, forcing it on to the piston,



Showing set up of pump unit with hand flushing lever

between the rings, at or near the end of the power stroke. It is built on the unit principle with an individual pumping unit for each point to be lubricated.

To remove a unit it is only necessary to disconnect the feed pipe at the oil outlet, remove the three screws holding it to the cover and lift it out. The unit can then be repaired, or a new one substituted and the removed part examined at leisure. On the older type lubricator it was necessary to stop the lubricator and disassemble it in order to remove an individual unit.

A check valve in the ball joint at the pump outlet prevents oil from emptying out of the feed pipe when a unit is being removed or repaired, so that when the unit is replaced and the pipe re-connected, it is not necessary to wait until the feed pipe is again filled with oil.

Another advantage is that the oil does not pass through the reservoir after it is shown in the glass. It has passed all possible places of mechanical leakage after passing through the glass, with the exceptions, of course, of the pipe connections themselves, but these are exposed and any leakage there can be quickly detected.

Individual pumps are fitted for hand flushing, so that any point may be given an extra supply of oil without interfering with the amount supplied to other points.

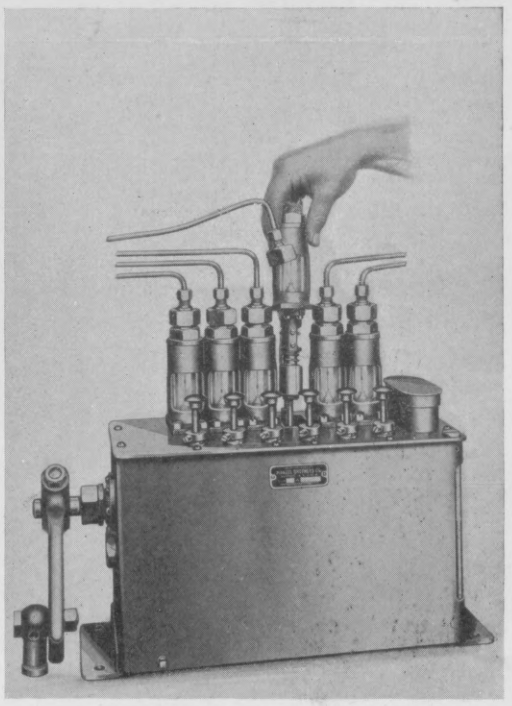
When the lubricator is in operation on the downward stroke of the plunger, oil is drawn through the strainer and tube into the small pocket on the side of the plunger. As the plunger is forced upward by the cam, a measured quantity of oil is forced before it, causing the piston valve to open. The oil is then forced on through the nozzle and the glycerine-filled sight glass, and as the plunger is returned to its original position by the spring, the piston valve above the plunger closes the port, preventing oil from returning to the reservoir. There is a solid body of liquid in the oil line from the instant the oil leaves the pumping unit until it reaches the point to be lubricated, thus insuring a feeding of oil at every stroke of the pump plunger.

The feed of each unit is adjusted independently, and may be set to supply minute particles of 1 drop per stroke or increased to a maximum of 5 drops.

Regulation is effected by raising or lowering the cam lever on the regulating screw. Turning the feed regulator on top of the oiler to the left raises the lever and the higher it is raised, the greater the stroke of the lubricator plunger and the larger the amount of oil supplied. Turning to the right decreases the stroke and, consequently, decreases the amount of oil measured out by the plunger. The feed may be adjusted at any time while the engine is running.

The cams are arranged to give quick action to the plungers, the actual working stroke requiring only 45 deg. These cams are placed in different positions on the driving shaft to meet the timing requirements of any type of engine. They may be arranged to operate 45 deg., 60 deg., 90 deg., 120 deg., or any number of degrees apart, to synchronize with the stroke of the pistons on the various engines.

Heavy tubular sight glasses, capable of withstanding 1200 lb. pressure, are used for the sight feed, making the use of bull's-eye glasses for air compressor cylinders unneces-



Shows compact set up and ease of removal of pumping unit

sary except in special cases of extremely high pressure.

These lubricators are furnished with from 1 to 16 feeds and with direct lever, direct rotary, ratchet or reduced rotary drive.

Review of Recent Publication

Transportation on the Great Lakes

Prepared by the Board of Engineers for Rivers and Harbors, War Department, in cooperation with the U. S. Shipping Board. 6 in. x 9 in. x 1½ in. 426 pp. Charts, illustrations and diagrams. Obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C. Price $1.50.

A full discussion of water transportation facilities and problems on the Great Lakes is included in this book, which is the first of a series dealing with the transportation problems directly related to the functions of the War Department and the Shipping Board, and is the result of investigations conducted in accordance with the provisions of the Transportation Act and the Merchant Marine Act.

The report contains a general description of the Great Lakes and their connecting channels and harbors, and gives information relative to laws, treaties and regulations governing navigation and traffic on these waters. It shows in considerable detail the development of commerce and shipping on the lakes. The larger portion of the report, however, is devoted to an intensive study of the movements of the important bulk commodities, of which grain, iron ore and coal comprise the greater share of the traffic. Other commodities covered by the report are limestone, petroleum, forest products, sand and gravel. The package freight movement is shown for each port and information is given regarding the lines engaged in this service and the terminals available for handling package freight. The car ferry service is also described and information given regarding the traffic handled.

The movements of grain, iron ore and coal on the Great Lakes are shown with more completeness than has heretofore been possible. Since the Lakes constitute for a large share of the traffic an important part of a through route, it is regarded as important to show such movements from origin to destination. In the case of grain, the shipments are shown from each state to the various upper lake ports, thence by water down the lakes to lower lake ports. Similarly, the iron ore is traced from the various ranges to the ports of shipment, thence by way of the Great Lakes to the receiving ports, and from the latter by rail to the various destinations. Coal moving from mines in Pennsylvania, West Virginia, Kentucky and Ohio, is traced to Lake Erie ports and thence by water to the upper lake ports, from which points the movements are still further shown to the states of destination.

The terminal facilities at the ports for handling bulk commodities are described and information is given as to the costs of transportation including all terminal charges involved between points of origin and destination.

The report shows that the average annual receipts of grain at upper lake ports during the four years 1920-1923 amounted to more than 707,000,000 bushels.

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Personal

A. C. Hardy, who was appointed editor of MOTORSHIP at the beginning of the new year, is one of the most promising and brilliant of the younger school of marine writers. He is already the author of four books on marine matters and of several papers read before technical societies, and in all his writings demonstrates the free and unfettered outlook on marine matters that is essential in the editorial conduct of a magazine like MOTORSHIP devoted to progress and development. His education and training have fallen entirely within the motorship era; he has not been required, as so many older men have, to jettison traditions in order to accept the motorvessel as the most modern development of shipping economics. In his book entitled "Motorships," he emphasizes very strongly what the shipping world is today beginning to accept, that the motorship era will bring about great changes

A. C. Hardy, B.Sc., editor and author

in marine architecture, for the motorship is not to be regarded as a steamer with an oil engine replacing the steam machinery, but must be viewed as a new type of ship presenting wide scope for improvements in structure, internal arrangements and efficiency that were not possible with any older form of power. That progressive and enlightening attitude is characteristic of all his work. It is manifest in his other books, "Merchant Ship Types," "Bulk Cargoes" and "From Slip to Sea." His next book—"American Ship Types," the only book written dealing with the characteristics of our many domestic ship types—will be published this year. Mr. Hardy served five years' apprenticeship with Palmer's Shipbuilding and Iron Co. at Jarrow-on-Tyne, prior to taking the course in Naval Architecture at Armstrong College, Newcastle, England, where he gained his B.Sc. He was fortunate in serving part of his long apprenticeship in wartime when there was never a vacant slip in the yard, when all manner of unusual craft were being built, vessels coming in for repairs with stern blown off, holds agape or bow torn open, and when ship trials were numerous. For a time he was engaged in the office of a consulting marine engineer and naval architect and then joined the staff of *The Marine Engineer* and of *Shipbuilding & Shipping Record* in London. At intervals he has shipped on long voyages, gaining experience both on deck and in the engine-room—in fact, it was on one of these voyages as a carpenter's mate that he first set foot in this country. Mr. Hardy is a member of several technical societies and institutions and is also a Fellow of the Royal Geographical Society, London.

T. Orchard Lisle, for many years editor of MOTORSHIP, has been appointed manager of the magazine, a position he has virtually filled for the last two years, during which period he has devoted all his time to the business side of the publication. Mr. Lisle was the first contributor of technical articles to MOTORSHIP and was appointed editor soon after the publication of the first number in 1916. For many years his writings in this magazine formed the only forceful presentation of the merits of the motorship, not alone in this country but in the whole world. MOTORSHIP was for long the only publication that fought the prejudices of a marine world that was still dominated by steam, and great credit is due to Mr. Lisle for his strong and able conduct of the long and arduous fight for the recognition of the marine Diesel engine by the shipping world. Gradually the conservatism that opposed the motorship was broken down; other marine magazines recognized the way the wind was blowing and tempered their opposition; a new magazine with a title similar to ours made its appearance in England; shipowners were won over; and today half of the world's new shipbuilding construction is oil-engined. During the last five years this magazine has continued to lead. It dominates in the American field and has given impetus to the development of the motorvessel on lake, river and sea until practically no type of vessel remains that has not been demonstrated superior with an oil engine to its steam prototype. It watches carefully European progress and deals with all new developments or advances in the art abroad. In all of this Mr. Lisle played an important role, and the services he rendered to the motorship movement in its hard-scrapping youth have earned for him a solid reputation both here and abroad.

F it were unlawful to have dirty engine rooms we wonder how many would start bootlegging filth?

A pair of "mics" were never intended to be used as a C clamp.

Of course we all know how much we know about our own job, but how many know how much the boss knows about his?

Sometimes the difference between one ship and another is not a difference in ships but a difference in men.

A little grit in a bearing is just about as good as a wiped out bearing.

That reminds us that if you run your hands over a crank pin or journal you can feel the grit, but you can't feel it through a rag.

Exhaust gases rolled up to the sky—
A black cloud a mile or two high.
Now the engine is busted;
Pistons, carbon encrusted,
Seized, under the engineer's eye.

A crank-box proceeded to pound
With a loud deafening sound.
Preignition was blamed,
But the crank-box untamed
Broke away and has never been found.

An engine was laboring hard
Said the engineer, "I'd take a card,
And learn what is wrong
If the boss, for a song
Had bought the equipment requir'd."

A man in turning a switch
Got a shock and said, "Son of a — Which
End of that thing
Carries a sting—
Or a kick, or a jolt that is rich.

There never was a perfect engineer, nor editor, nor columnist and that includes all of us.

When you discover a pump way back in the corner of the engine room practicing the Charleston it is time to get out a wrench and pull down on the fastening-down bolts.

By playing cards with the crew a licensed man places himself on their level, but that is not the worst of it. He, too, often makes the men feel that they are on a level with the other officers, and despite our aversion to pomp and circumstance we feel that all men should climb without false ideas of who they are.

The engine that is making the most noise is not always the one that does the work.

No use to attempt to cure the effect without eliminating the cause. Away back in 1678 Abbé Hautefeuille designed an internal combustion engine to use powder as fuel. Wonder what the Abbé would think of the GRIPSHOLM if he could see her?

A Warning

We have received the following communication from the New London Ship & Engine Company, Croton, Conn.:

The trade is hereby warned against the activities of Charles Judson Feldmiller, or Miller, representing himself to be an agent of either the King Knight Company of San Francisco, California, or of the New London Ship & Engine Company of New London, Conn. This man is wanted in San Francisco for passing worthless checks and for obtaining money under false pretenses. He is 6 ft. 3 in. in height, weighs 212 lb., has black hair, combed straight back, is dark complexioned, and has a bald spot on the right side of his head over which he combs his hair to conceal. When last seen he was dressed in a dark blue suit with lighter stripes and a grey-blue overcoat which he obtained fraudulently. These were made by the firm of Hing Chong & Co., Chinese tailors, 525 Kearny street, San Francisco, Cal. Anyone knowing this man's whereabouts, should at once communicate with Arthur J. Holton, Mercantile Trust Co., 464 California street, San Francisco, Cal.

Atlas Imperial Engine Company, Oakland, Calif., announces a radical reduction in prices on 4-cycle, airless injection Diesel Engines, effective January 1st. A copy of this revised list may be obtained from their head office.

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